Work Plan for a Demonstration of Groundwater Remediation by Natural Attenuation at Facility 1381

Cape Canaveral Air Station
Florida

Prepared For

Air Force Center for Environmental Excellence
Technology Transfer Division
Brooks Air Force Base
San Antonio, Texas

and

Cape Canaveral Air Station
Florida

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WORK PLAN FOR A DEMONSTRATION OF GROUNDWATER REMEDIATION BY NATURAL ATTENUATION AT FACILITY 1381 CAPE CANAVERAL AIR STATION, FLORIDA

Prepared for:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
TECHNOLOGY TRANSFER DIVISION
BROOKS AIR FORCE BASE
SAN ANTONIO, TEXAS

AND

CAPE CANAVERAL AIR STATION, FLORIDA

August 1996

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SECTION 1

INTRODUCTION

This work plan, prepared by Parsons Engineering Science, Inc. (Parsons ES), presents the scope of work required for the collection of data necessary to demonstrate remediation by natural attenuation (RNA) of groundwater contaminated with chlorinated aliphatic hydrocarbons (CAHs) at the Ordnance Support Facility (Facility 1381), located in Area 5 at Cape Canaveral Air Station (CCAS), Florida. Because other contaminants present at this site are found in relatively low concentrations, this demonstration will focus on the CAH plume emanating from Facility 1381. Hydrogeologic and groundwater chemical data collected under this program can also be used to evaluate various engineered remedial options; however, this work plan is oriented toward the collection of hydrogeologic data to be used as input into groundwater flow and solute transport models in support of RNA with long-term monitoring (LTM) for restoration of groundwater contaminated with CAHs. At Facility 1381, air sparging of the source area is planned and operations will begin in August or September 1996.

As used in this report, RNA refers to a management strategy that relies on natural attenuation mechanisms to remediate contaminants dissolved in groundwater and to control receptor exposure risks associated with contaminants in the subsurface. The United States Environmental Protection Agency (USEPA) Offices of Research and Development (ORD) and Solid Waste and Emergency Response (OSWER) define natural attenuation as:

> *The biodegradation, dispersion, sorption, volatilization, and/or chemical and biochemical stabilization of contaminants to effectively reduce contaminant toxicity, mobility, or volume to levels that are protective of human health and the ecosystem.*

As suggested by this definition, mechanisms for natural attenuation of CAHs include advection, dispersion, dilution from recharge, sorption, volatilization, abiotic chemical transformation, and biodegradation. Of these processes, biodegradation is the only significant mechanism working to transform contaminants into innocuous byproducts. During biodegradation, indigenous microorganisms work to bring about a reduction in the total mass of contamination in the subsurface without the engineered addition of nutrients. Patterns and rates of natural attenuation can vary markedly from site to site depending on governing physical and chemical processes.

RNA is advantageous for the following reasons:

- Contaminants are transformed to innocuous byproducts (e.g., carbon dioxide, ethene, or water), not just transferred to another phase or location within the environment;
- Current pump-and-treat technologies are energy-intensive and generally not as effective in reducing residual contamination;
- The process is nonintrusive and allows continuing use of infrastructure during remediation;
- Engineered remedial technologies may pose a greater risk to potential receptors than RNA (e.g., contaminants may be transferred into another medium during remediation activities); and
- RNA is less costly than conventional, engineered remedial technologies.

Evaluation of RNA for Facility 1381 at CCAS will involve completion of several tasks, which are described in the following sections.

This work plan was developed on available site characterization data that were reviewed during the preparation of this work plan. All field work will follow the health and safety procedures presented in the program *Health and Safety Plan for Bioplume II Modeling Initiative* [Parsons Engineering Science, Inc. (Parsons ES), 1996] and the site-specific addendum to the program Health and Safety Plan. This work plan was prepared for the Air Force Center for Environmental Excellence (AFCEE) and CCAS. This work is not intended to fulfill the requirements of a contamination assessment report, a remedial action plan (RAP), corrective measures study (CMS) or any other document specified in federal or state regulations; rather, it is provided for the use of CCAS, its prime environmental contractors, and regulators as information to be used for future decision-making regarding this site, unless otherwise requested by AFCEE or the AS. As a result, data collection, analysis, and modeling performed as part of this demonstration of RNA will be incorporated into the Facility 1381 CMS to explore the potential of RNA as an alternative for site restoration.

1.1 SCOPE OF CURRENT WORK PLAN

The ultimate objective of the work described herein is to provide a site-specific demonstration to support the use of RNA for groundwater contamination in conjunction with other remedial actions at Facility 1381. However, this project is part of a larger, broad-based initiative being conducted by AFCEE in conjunction with the USEPA National Risk Management Research Laboratory (NRMRL) (formerly the USEPA's Robert S. Kerr Environmental Research Laboratory) and Parsons ES to document and evaluate the biodegradation and resulting attenuation of solvents and fuel hydrocarbons dissolved in groundwater, and to model this degradation using numerical or analytical solute transport models. For this reason, the work described in this work plan is

directed in part toward the collection of data in support of implementation of this initiative at this site. Pilot test air sparging in the source area will begin in August or September 1996 to strip CAHs from groundwater before they can discharge to adjacent drainage canals. The effects of this action on RNA will be considered.

The intent of this RNA demonstration program is to develop a systematic process for scientifically investigating and documenting naturally occurring chemical attenuation processes that can be factored into overall site remediation plans. The objective of the program and this specific demonstration is to provide solid evidence of RNA of CAHs dissolved in groundwater so that this information can be used by CCAS to develop an effective groundwater remediation strategy for Facility 1381. As a result, these demonstrations are not necessarily intended to fulfill specific federal or state requirements regarding site assessments, RAPs, CMSs, or other such mandated investigations and reports. However, data collection, analysis, and modeling performed as part of this RNA demonstration will be used in the Facility 1381 CMS to document the potential of RNA as a remedial alternative for the site. A secondary goal of this multi-site initiative is to provide a database from multiple sites that demonstrates that natural processes of contaminant degradation often can reduce contaminant concentrations in groundwater below acceptable cleanup standards before potential receptor exposure pathways are completed.

This work plan describes the site characterization activities to be performed by personnel from Parsons ES and the Subsurface Protection and Remediation Division of the NRMRL in support of the demonstration and the groundwater modeling effort. Field activities will be performed to evaluate the effectiveness of RNA in remediating the dissolved CAH plume at Facility 1381. Drainage canals bounding the site on the southwest and northeast govern groundwater flow characteristics and create a groundwater divide that splits the groundwater plume into two flow directions: flow directly into a drainage canal approximately 300 feet southwest, and flow toward a drainage canal approximately 2,500 feet north-northwest. Potential CAH discharge into the canal to the southwest will be mitigated by the air sparging system installed in the southern portion of the source area. The data collected during this demonstration will focus on contaminant and geochemical characteristics of groundwater migrating to the north-northwest. These data, along with data from previous investigations, will be used to characterize contaminant and geochemical patterns at the site and to the north-northwest, and as input for groundwater flow and solute transport models to make predictions of the future concentrations and extent of contamination migrating to the north-northwest. More detailed information regarding aquifer flow characteristics and future air-sparging operations are described in Section 2.

Site characterization activities in support of the demonstration will include: 1) determination of preferential contaminant migration and potential receptor exposure pathways; 2) soil sampling using Geoprobe® direct-push technology; 3) groundwater monitoring point installation using the Geoprobe®; 4) groundwater sampling from Geoprobe® installed monitoring points; 5) groundwater sampling from monitoring wells; and 6) aquifer testing. The materials and methodologies to accomplish these activities are described herein. Previously reported site-specific data and data to be

collected during the supplemental site characterization activities described in this work plan will be used to develop a conceptual model of contaminant transport and natural attenuation at the site. Following development of the conceptual model, the data will be used as input for the groundwater flow and solute transport models. Where site-specific data are not available, conservative values for the types of aquifer materials present at the site will be obtained from widely accepted published literature and used for model input. Sensitivity analyses will be conducted for the parameters that are known to have the greatest influence on the model results, and where possible, the model will be calibrated using historical site data. Upon completion of the modeling, Parsons ES will provide technical assistance at regulatory negotiations to support RNA if the results of the sampling, data analysis, and modeling indicate that this approach is warranted. If it is shown that RNA is not an appropriate remedial option, Parsons ES will suggest another groundwater remedial technology on the basis of available data.

This work plan consists of six sections, including this introduction. Section 2 presents a review of available previously reported, site-specific data and conceptual models for the site. Section 3 describes the proposed sampling strategy and procedures to be used for the collection of additional site characterization data. Section 4 describes the quality assurance/quality control (QA/QC) measures to be used during this project. Section 5 describes the remedial option evaluation procedure. An example of a report format is not included because data collected as part of this study will be formally presented as an appendix to the CMS report being prepared for Facility 1381 by Parsons ES (in preparation). Section 6 contains the references used in preparing this document. There are three appendices to this work plan. Appendix A summarizes analytical data for organic compounds detected in site sediments, soils, groundwater, and surface water and contains soil boring logs. Appendix B contains a listing of containers, preservatives, packaging, and shipping requirements for soil, sediment, groundwater, and surface water analytical samples. Appendix C contains installation diagrams of the pilot air-sparging system and descriptions of sparging monitoring wells, soil gas monitoring points, and sparging wells.

1.2 BACKGROUND

CCAS is located on the east coast of Florida on a barrier island in Brevard County. The main complex occupies about 25 square miles of assembly and launch facilities for missiles and space vehicles. The property is bounded by the Atlantic Ocean on the east and the Banana River on the west. The southern boundary is a man-made shipping channel, and the John F. Kennedy Space Center adjoins CCAS to the north. Since 1950, CCAS has been a proving ground for US Department of Defense military missile programs, including the Bomarc, Matador, Redstone, Atlas, Titan, and the Navy Trident programs.

The Ordnance Support Facility (Facility 1381), formerly the Guidance Azimuth Transfer (GAT) building and the In-Place Cleaning Facility, is located along the landfill access road in Area 5 of CCAS. The site is part of the CCAS Central Area Operable Unit (CENTRAL OU). Figure 1.1 shows the location of Facility 1381 at CCAS. The site is enclosed within a chain-link fence, and access is controlled. South

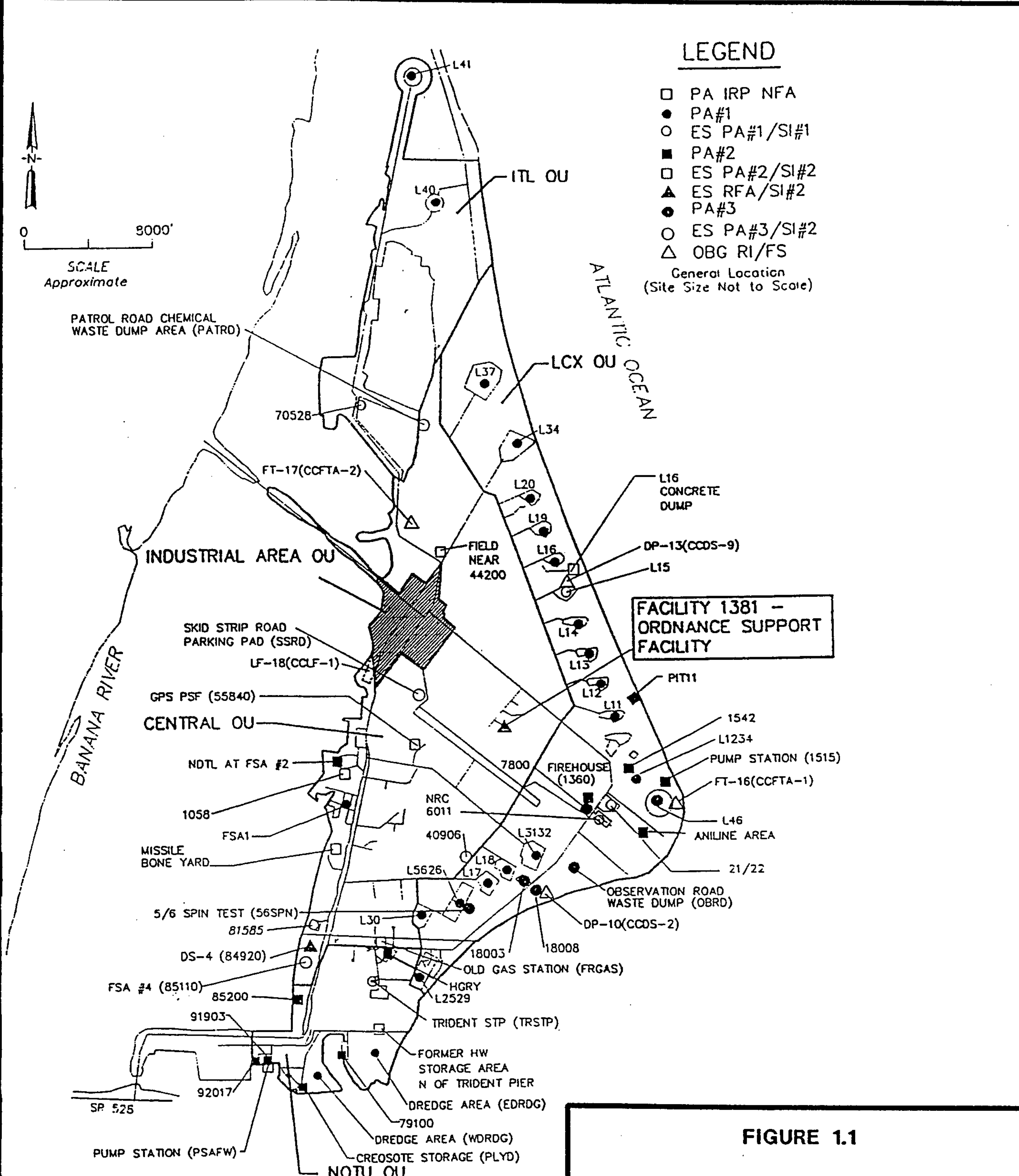

FIGURE 1.1

LOCATION OF FACILITY 1381

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

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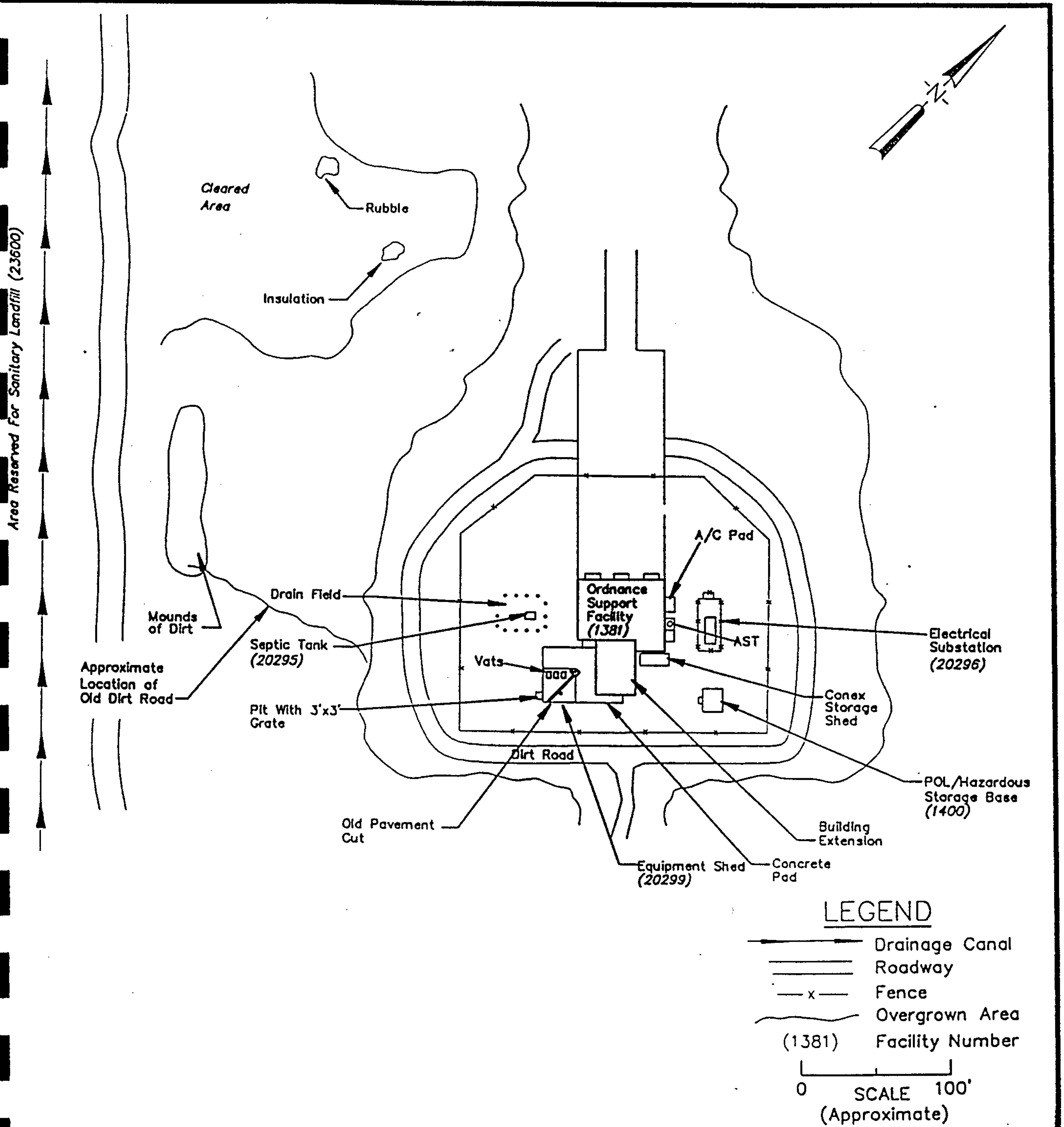
of the facility, across the drainage canal, is the CCAS landfill. The following facilities are located within the chain-link fence and are depicted on Figure 1.2: Ordnance Support Building (1381), Petroleum, Oils, and Lubrication (POL)/Hazardous Storage Base (1400), Sewage Septic Tank and Drain Field (20295), Electrical Substation (20296), and the Equipment Shed (20299). Areas of concern (AOCs) at Facility 1381 include the support Facility Equipment Shed (AOC - 517), the former Acid Neutralization Pit (AOC-518), and the Drainfield/Septic Tank (AOC-519).

Over its 38-year history, ownership and operations of Facility 1381 have changed several times. Facility 1381 originally may have been used for research, testing, and/or instruction of missile/space technology, although historic information about the site between 1958 and 1968 is limited. During the operation of an In-Place Precision Cleaning Lab (1968-1977), the building housed acid and solvent dip tanks for cleaning metal components. According to the ESE (1984) Phase I Report, waste TCE was generated at a rate of approximately 3,300 gallons per year (gal/yr) from a parts dip tank. The waste TCE was initially drummed, taken to Launch Complex 15 (L15 on Figure 1.1), and then incinerated. Beginning in 1972, TCE was incinerated in a boiler at CCAS (ESE, 1984). Waste nitric and hydrochloric cleaning acids also were used within the facility. A 4-foot by 40-foot by 2.5-foot lined, stainless steel acid dip tank was used to clean pipe. The waste acids were then disposed of by discharging them into a neutralization pit filled with crushed limestone, located southwest of the building.

The US Coast Guard has operated the site as the Ordnance Support Facility since 1977. According to site personnel, the only change that has occurred at the facility since the Coast Guard assumed ownership in 1977 was the addition of three dip tanks and electrical hardwiring (Parsons ES, in preparation). According to an interviewee on May 2-6, 1992, the dip tanks contained acid (Fozdip), oil, and, water. The other drums contained acid and oil, or a degreaser.

The acid neutralization pit has not been clearly identified from site reconnaissance, nor clearly located in previous reports and construction blueprints. Previous descriptions of likely pit locations have placed it within the dimensions of the septic field or 30 to 40 feet southwest of Facility 1381 (ESE, 1984). The pit was reportedly filled with crushed limestone during operation, but later filled with soil. Blueprints and records describing the design of Facility 1381 noted that the septic field consisted of a 500-gallon septic tank and a 3-foot by 20-inch distribution box. The septic drain field has been in place since 1958, and no notable features such as a limestone pit appear to have been incorporated into its design. Therefore, the septic drain field is not suspected to coincide with the former location of the acid neutralization pit.

Aerial photographs and blueprints and a site reconnaissance have confirmed the presence of a concrete pit with a grate located approximately 45 to 50 feet southwest of Facility 1381 (Figure 1.2). The construction of this pit is not consistent with the reported design and function of the acid neutralization pit. The observed concrete pit was constructed with metal grates and concrete walls, which acid would corrode. Furthermore, the concrete pit was filled with water instead of soil (as previously



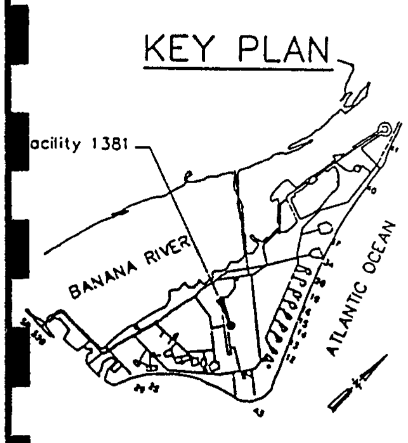


FIGURE 1.2

SITE MAP OF FACILITY 1381

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

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described). Therefore, the observed concrete pit does not appear to be the acid neutralization pit, although it is in the general suspected location of the latter structure. To date, the exact location of the acid neutralization pit remains uncertain.

In June 1994, the concrete pit located at the south-western corner of the concrete pad was pumped out in order to investigate the structural integrity of the concrete. The pit is approximately 4 feet deep, and no cracks or leaks were observed in the concrete sides and bottom. The pit was subsequently decontaminated and sealed. The contents of the pit were disposed of at a hazardous waste disposal facility.

Chlorinated solvent contamination at the site is suspected to have resulted from accidental releases from past metal cleaning operations. In the earliest available photograph of the site, taken in 1967, several drums were visible resting on the ground surface at various locations across the site. During site reconnaissance conducted as part of the 1989 RFA, several drums were discovered outside the fenced area southwest of Facility 1381 (USEPA, 1989). It is suspected that drums containing chlorinated volatile organic compounds (VOCs) were periodically stored at this location and contributed to soil and groundwater contamination.

Work performed between June 1993 and March 1995 as part of the site investigation (Parsons ES, in preparation) included:

- Performance of a soil gas survey;
- Performance of a geophysical survey;
- Installation and sampling of one deep and two shallow groundwater monitoring wells; and
- Installation and sampling of four soil borings.

Work performed as part of the RCRA Facility Investigation (RFI) (Parsons ES, in preparation) from December 1995 to current included:

- Collection of groundwater samples from 67 HydroPunch® locations located throughout the Facility 1381 area;
- Installation and sampling of 14 shallow wells, 2 intermediate-depth wells, 12 deep wells, and 3 piezometers;
- Advancement of a total of 15 soil boreholes and the collection/analysis of 30 soil samples from these borings; and
- Collection of 9 surface water samples and 7 sediment samples in the vicinity of the site.

In anticipation of the air sparging system start-up (Section 1.3) and aeration of groundwater beneath Facility 1381, several wells were sampled for contaminants and geochemical parameters on August 15, 1996. Monitoring wells 1381MWS09, 1381MWI09, 1381MWD09, 1381MWS01, and 1381MWD01 were sampled for all required natural attenuation parameters. These data will be combined with data collected under this work plan to evaluate and document potential RNA of dissolved CAHs at the site. The parameters measured at the site are discussed in greater detail in Section 3.

1.3 SITE REMEDIATION ACTIVITY

At Facility 1381, an air sparging system is being installed and will begin operation in late August or early September 1996. The sparging system is located south of Facility 1381 and adjacent to the outer perimeter fence surrounding the facility. The air sparging system covers an area measuring 100 feet by 100 feet outside of the fenced area. Preliminary figures for the design of the air sparging system are included in Appendix C. The air sparging system consists of three sparging locations each consisting of a shallow [24 feet below ground surface (bgs)], an intermediate-depth (36 feet bgs), and a deep (48 feet bgs) sparging well. System performance will be monitored at 14 soil gas monitoring points and 6 groundwater monitoring point locations. The groundwater monitoring point locations consist of three monitoring well intervals: a 10-foot screened monitoring point beginning at 9 feet bgs; a 5-foot screened monitoring point beginning at 26 feet bgs; and a 5-foot screened monitoring point beginning at 39 feet bgs. The air sparging system will attempt to strip dissolved CAHs from groundwater that is migrating from the source area at Facility 1381 to the drainage canal approximately 300 feet to the southwest.

SECTION 2

DATA REVIEW AND CONCEPTUAL MODEL DEVELOPMENT

Existing site-specific data were reviewed and used to develop preliminary conceptual models for groundwater flow and contaminant transport at Facility 1381. Section 2.1 presents a synopsis of available site characterization data. Section 2.2 presents the preliminary conceptual groundwater flow and contaminant transport models that were developed based on these data. The conceptual models guided the development of sampling locations and analytical data requirements needed to support the modeling efforts and to evaluate potential remediation technologies, including RNA. Sampling locations and analytical data requirements are discussed in Section 3.

2.1 DATA REVIEW

The following sections are based upon review of data from the following sources:

- Phase I Report (ESE, 1984);
- RFA Report (USEPA, 1989);
- RFA Preliminary Assessment Report (Parsons ES, 1993);
- SI Report (Parsons ES, 1995); and
- RFI Summary Report (Parsons ES, in preparation).

2.1.1 Topography, Surface Hydrology, and Climate

CCAS is located on a barrier island between the Atlantic Ocean (to the east) and the Banana River. Facility 1381 is located off the landfill access road in Area 5 of the CENTRAL OU at CCAS. Figure 1.1 shows the location of Facility 1381 at CCAS addressed by Installation Restoration Program (IRP) activities. The site is enclosed within a chain-link fence, and access is controlled. South of the facility, across a drainage canal, is the CCAS landfill. There are no other facilities adjacent to this site.

The cover types in the area immediately surrounding Facility 1381 consist mainly of mowed grass, pavement, and bare soils. Terrestrial vegetation in undeveloped portions of the study area includes periodically mowed coastal scrub. Aquatic and wetland habitats are present along the drainage canals to the southwest and north/northwest. Emergent wetlands are located near Central Control Road (to the north).

The surface water drainage system at CCAS consists of manmade ditches, culverts, and canals that collect runoff and convey it generally westward to the Banana River. The drainage canal closest to Facility 1381 is located between the facility and the CCAS landfill, approximately 300 feet southwest of the site. This canal flows from the southeast to the northwest. A second westerly flowing canal is located approximately 2,500 feet north/northwest of the site. Two surface water gauging stations and one stilling gauge are located in the canal located southwest of Facility 1381 adjacent to the landfill. Surface water elevation measurements have been consistently lower than the surrounding groundwater elevations, indicating that groundwater discharges to surface water.

Typical of the barrier islands, a dune ridge just inland from the Atlantic Ocean beach provides a natural surface drainage divide. Very little runoff is naturally conveyed to the ocean; more than 90 percent flows into canals or percolates and flows westward as groundwater to the Banana River. The primary function of the drainage canal system at CCAS was land reclamation by lowering the water table. Therefore, in addition to providing drainage for the area, the drainage canal system exerts a major influence on shallow groundwater flow.

The climate of the barrier island is humid subtropical. Monthly mean high temperatures range from 69 degrees Fahrenheit (°F) in January to 87°F in July and August. Extreme high and low temperatures for the period from 1950 to 1980 were 99°F and 27°F, respectively. Rainfall is unevenly distributed throughout the year, with the period from June through October having distinctly more precipitation than the rest of the year. A 30-year (1950 to 1980) mean of the annual precipitation recorded at Patrick Air Force Base (AFB) south of CCAS, is 44.7 inches, with a mean annual evapotranspiration of 40.3 inches (ESE, 1991).

2.1.2 Overview of Geology and Hydrogeology

2.1.2.1 Regional Geology and Hydrogeology

Unconsolidated sediments in the CCAS area include undifferentiated marine sands overlying the Pleistocene-age Anastasia Formation and Caloosahatchee Marl Formation. The Anastasia Formation is a discontinuous layer of undifferentiated sands with silt and shells, and has not been documented in this area. The Caloosahatchee Marl Formation consists primarily of calcareous sand and shell deposits with interbedded calcareous sand, silt, and clay deposits.

Underlying the Caloosahatchee Formation is the Tamiami Formation, which consists of limestones, marls, silty sands, and clay. The Tamiami Formation forms a shallow bedrock aquifer. The marine sands, clays, and limestones of the Hawthorn Formation underlie the Tamiami Formation. Interspersed limestone layers form localized aquifers within the Hawthorn Formation. Beneath the Hawthorn Formation is the Floridan Aquifer, which consists of Ocala Formation limestone and extends to a depth of over 1,500 feet below msl. Figure 2.1 shows the generalized stratigraphic sequence for the area.

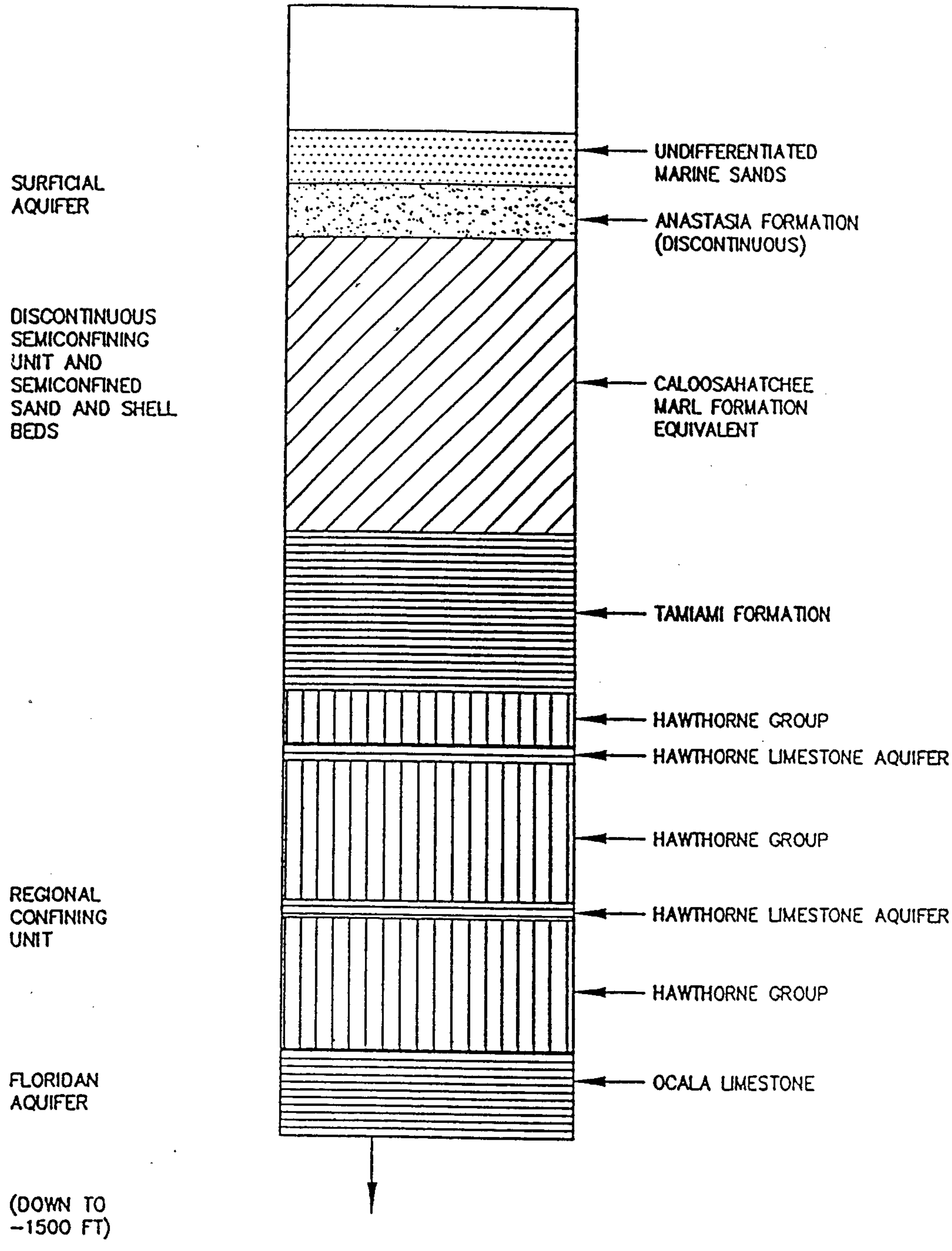

FIGURE 2.1

REGIONAL STRATOGRAPHIC SEQUENCE

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The unconfined surficial aquifer at CCAS includes the undifferentiated marine sands, the Anastasia Formation, the Caloosahatchee Marl, and the Tamiami Formation. The bottom of the surficial aquifer at CCAS is about 110 feet below mean sea level (msl), and is formed by clay units of the Hawthorn Formation (ESE, 1991).

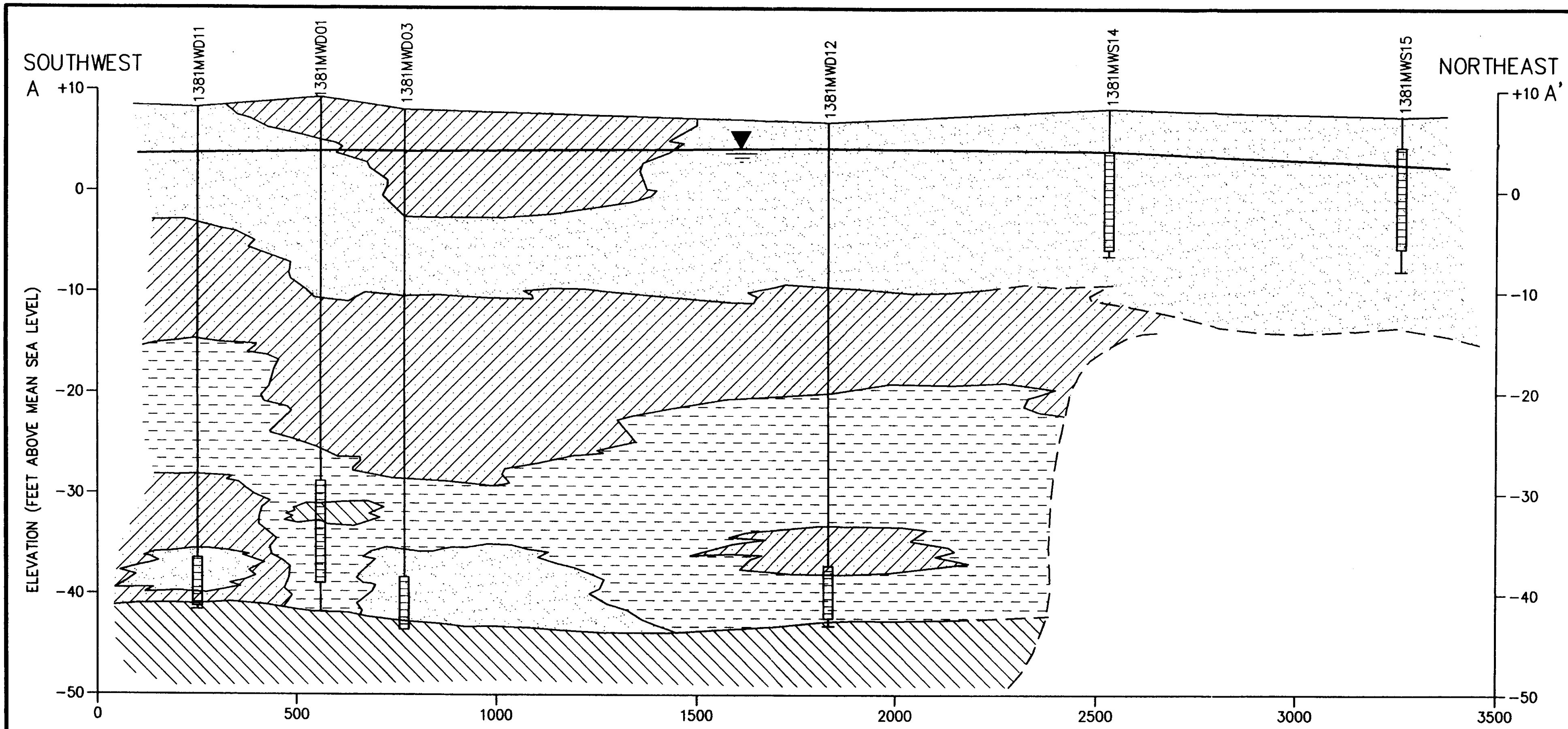
The likelihood of contamination of the deep aquifers from sources in the shallow aquifer is thought to be minimal. This is because the deep aquifers in the region generally have sufficient pressure head to cause the potentiometric surface for the deep aquifers to be higher than the water table within the shallow unconfined aquifer, thus preventing downward vertical groundwater flow (and the associated migration of contaminants) from the shallow aquifer into the deeper units.

Groundwater from beneath CCAS is not used for water supply purposes; the AS receives potable water from the city of Cocoa, Florida. When necessary, CCAS has access to a second potable water supply originating from the city of Melbourne and delivered by way of Patrick AFB. The groundwater at CCAS is currently classified as G-II by the Florida Department of Environmental Protection (FDEP) based on total dissolved solid levels, which permits possible future use (Parsons ES, in preparation). However, the potential for future development of CCAS groundwater as a potable water supply may be limited due to potential for saline intrusion and the controlled nature of CCAS.

2.1.2.2 Facility 1381 Geology and Hydrogeology

Geologic cross sections A-A' and B-B' were developed using available lithologic information obtained from boreholes during the installation of shallow and deep monitoring wells at the site (Figures 2.2 and 2.3). Borehole logs are included in Appendix A. The cross sections indicate that from the ground surface to approximately 35 feet bgs, the sediments consist of poorly-sorted coarse to fine sands and shell material, with little or no silts and clays present. The shell material is generally much coarser than the accompanying sands, and may be present as distinct lenses or layers, or disseminated throughout the sand units.

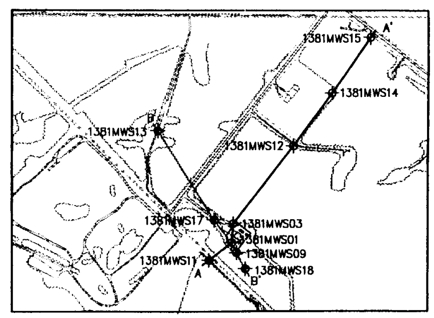
From approximately 35 feet bgs to approximately 50 feet bgs, sands show a decrease in grain size from the shallower sands, and the silt and clay content increases. Shell material is generally still present in varying percentages within this interval. Silt occurs as distinct layers or lenses within the sand and shell materials, or disseminated throughout some of the sandy layers. Clay begins to appear as distinct but generally minor firm layers and lenses within the upper portions of this interval, ranging from layers less than 1 inch in thickness to layers of sandy clay up to 6 inches or greater in thickness. These layers occur sporadically within the interval and are difficult to correlate from one boring to another. In the lower portion of the 35- to 50-foot interval, a mixture of sand, coarse oyster shell fragments, and unconsolidated clay is presence in most of the borings a Facility 1381. The clay here generally is not present as layers, but is disseminated throughout the sand/shell material as very loose layers or as "muddy" groundwater between shell fragments.



LEGEND

1382MWD11	BOREHOLE IDENTIFICATION
	WELL SCREEN (DASHED LINE = APPROX ELEVATION)
	BOTTOM OF BOREHOLE
	GEOLOGIC CONTACT
	DASHED WHERE INFERRED
	APPROXIMATE SHALLOW GROUNDWATER ELEVATION, JUNE 1996

	SAND, coarse to medium grained, some shell fragments, firm
	SAND, fine to very fine, some shell fragments, loose
	SILTY OR CLAYEY SAND, fine to medium grained, some shell fragments
	CLAY, firm, dry to moist



HORIZONTAL SCALE: 1" = 250'
VERTICAL SCALE: 1" =10'

FIGURE 2.2

HYDROGEOLOGIC CROSS-SECTION A-A'

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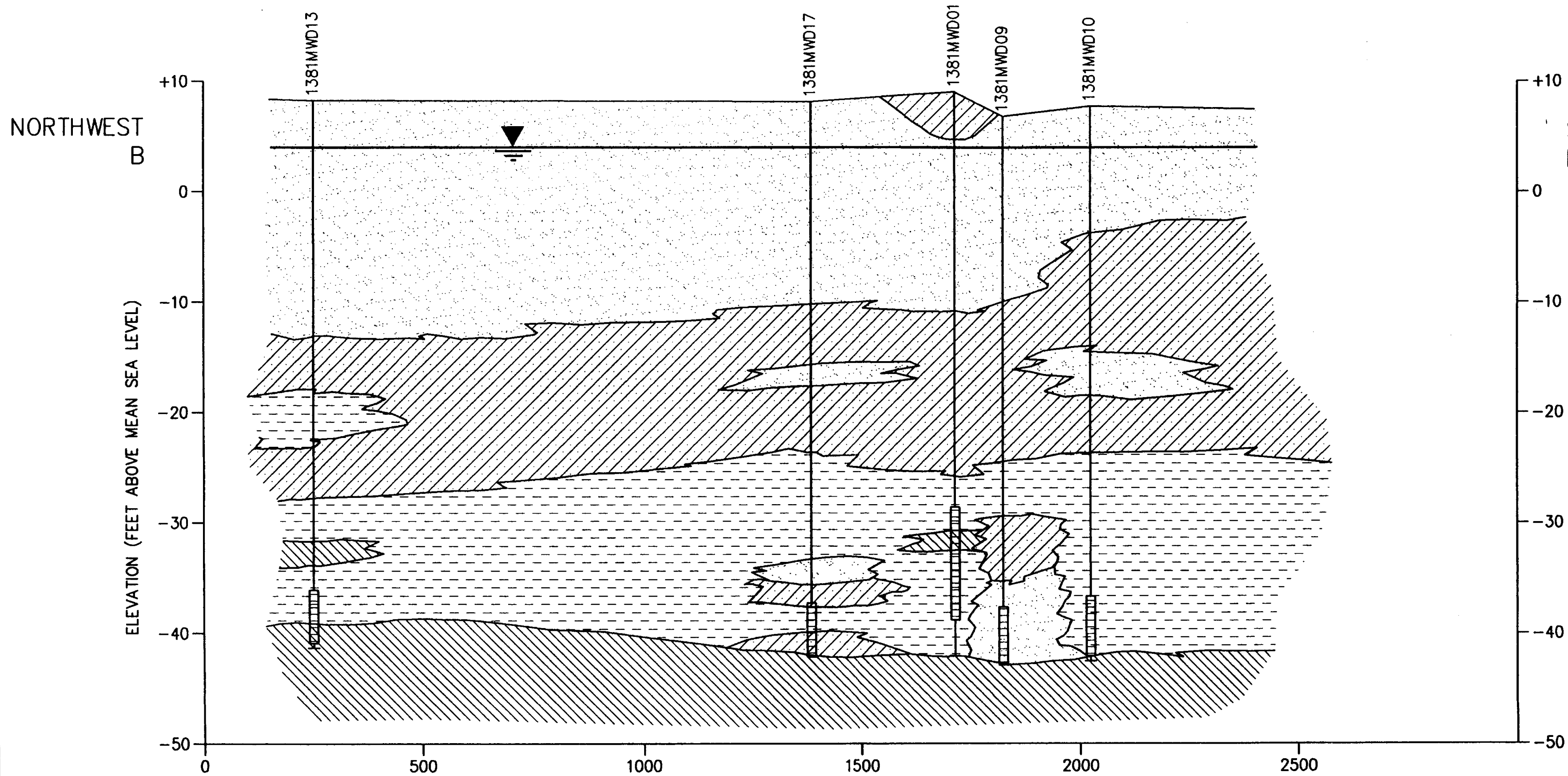
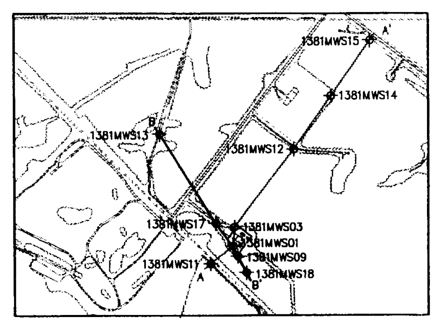


LEGEND

1381MWD13	BOREHOLE IDENTIFICATION		SAND, coarse to medium grained, some shell fragments, firm
	WELL SCREEN (DASHED LINE = APPROX ELEVATION)		SAND, fine to very fine, some shell fragments, loose
	BOTTOM OF BOREHOLE		SILTY OR CLAYEY SAND, fine to medium grained, some shell fragments
	GEOLOGIC CONTACT		CLAY, firm, dry to moist
	DASHED WHERE INFERRED		
	APPROXIMATE SHALLOW GROUNDWATER ELEVATION, JUNE 1996		



HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" =10'

FIGURE 2.3

HYDROGEOLOGIC CROSS-SECTION B-B'

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At depths ranging from 48.5 to 51 feet bgs, the borings encountered a continuous clay unit underlying the entire Facility 1381 area. This is interpreted to be the uppermost significant clay layer within the Caloosahatchee Marl. This clay unit is dark greenish gray to dark brown, very firm, and contains little to no sand or shell material. The presence of wood fragments and other plant material suggests a terriginous source for the clay. Based on split-spoon samples collected while drilling well 1381MWD04 to 80 feet bgs, this uppermost continuous clay unit appears to be approximately 9 feet thick. Deeper lithologic samples from this boring were predominantly sand, but indicated the presence of two 1-foot clay layers between 74 and 79 feet bgs. Given the thickness, composition, and continuity of the upper 9-foot thick clay layer, this unit probably acts as a significant confining layer within the Facility 1381 area.

There are currently 16 shallow monitoring wells, 2 shallow HydroPunch® monitoring points, 2 intermediate-depth monitoring wells, 13 deep monitoring wells, and 3 deep HydroPunch® monitoring points (Figures 2.4 and 2.5). All of these wells are screened in the surficial aquifer, with the exception of 1381MWD04, which is screened below the underlying clay layer. Available monitoring well construction details are presented in Table 2.1; HydroPunch® information is presented in Table 2.2. In addition, several monitoring wells are located at the landfill to the southwest of the site, although monitoring well construction details are not currently available.

Figure 2.6 shows the shallow groundwater elevation measured from shallow monitoring well locations in the surficial aquifer. Figure 2.7 shows the potentiometric surface of groundwater measured from deep monitoring well locations in the surficial aquifer. Table 2.3 presents available groundwater elevation information from groundwater sampling events conducted since January 1995.

The drainage canal system has a major influence on groundwater flow in the vicinity of Facility 1381. The primary function of the canal system at CCAS was land reclamation by lowering the water table. As a result, groundwater flow directions in the shallow surficial aquifer at CCAS are variable, depending upon proximity to a drainage canal. Two canals present in the vicinity of Facility 1381 appear to significantly influence local groundwater flow. One canal is located approximately 300 feet south-southwest of the facility, and the other is located approximately 2,500 feet north-northwest of the facility. Both canals flow westward toward the Banana River, and merge into a single canal approximately 0.65 mile northwest of Facility 1381. Figures 2.6 and 2.7 indicate that these canals influence groundwater flow directions.

Groundwater elevations in the shallow surficial aquifer as measured on June 19, 1996 range from 3.51 feet above msl (at monitoring well 1381MWD09 near the southwest canal) to 4.85 feet above msl (at monitoring well 1381MWS12 near the weather station). As illustrated on Figure 2.6 a west-northwest/south-southeast trending groundwater divide is evident in the vicinity of the weather station, with groundwater northeast of the divide flowing north toward the northeast canal, and groundwater southwest of the divide flowing southwest toward the canal adjacent to the landfill. Figure 2.6 also shows that groundwater in the landfill area flows northeast toward the landfill canal.

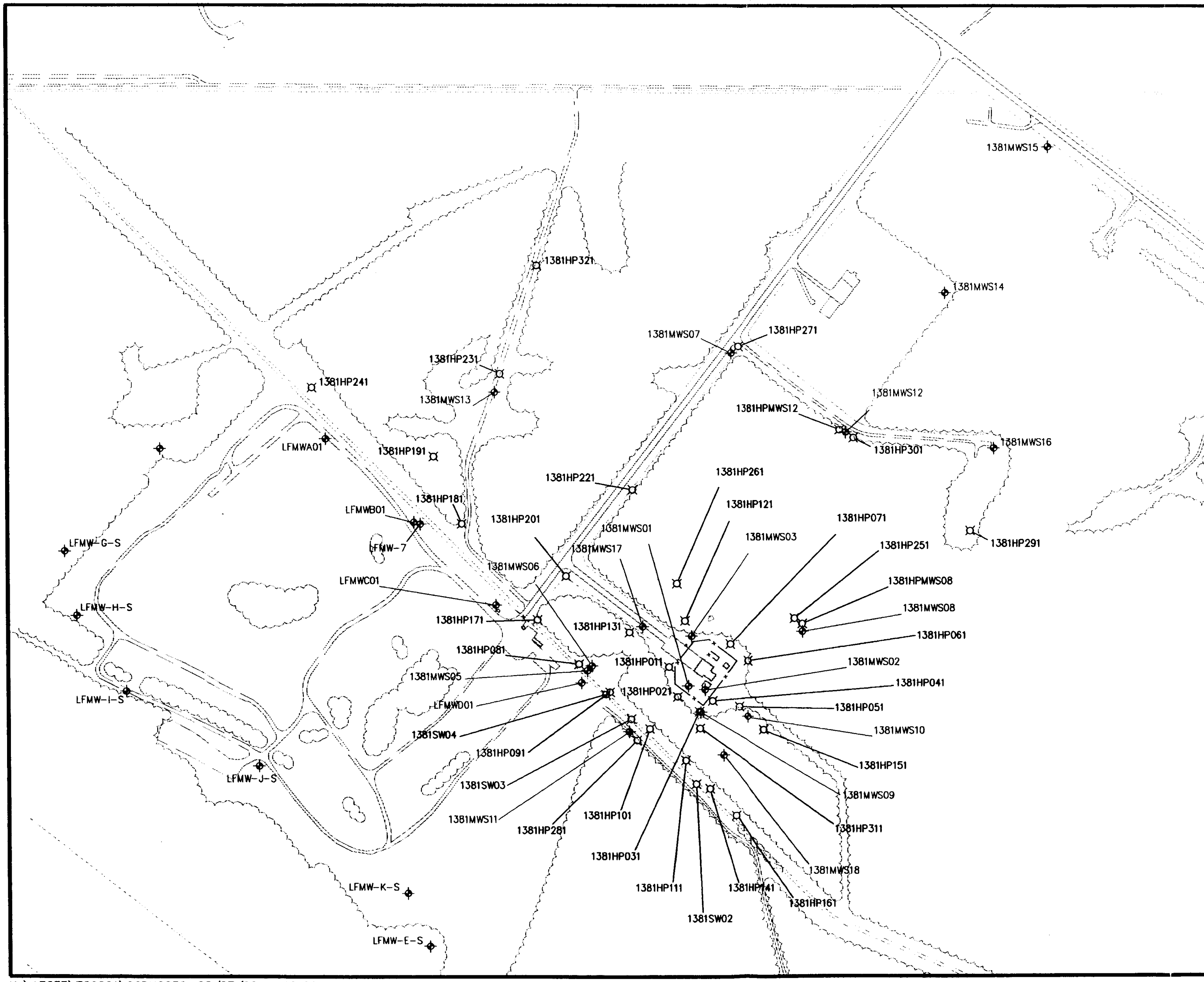

FIGURE 2.4

SHALLOW MONITORING WELL AND HYDROPUNCH LOCATIONS

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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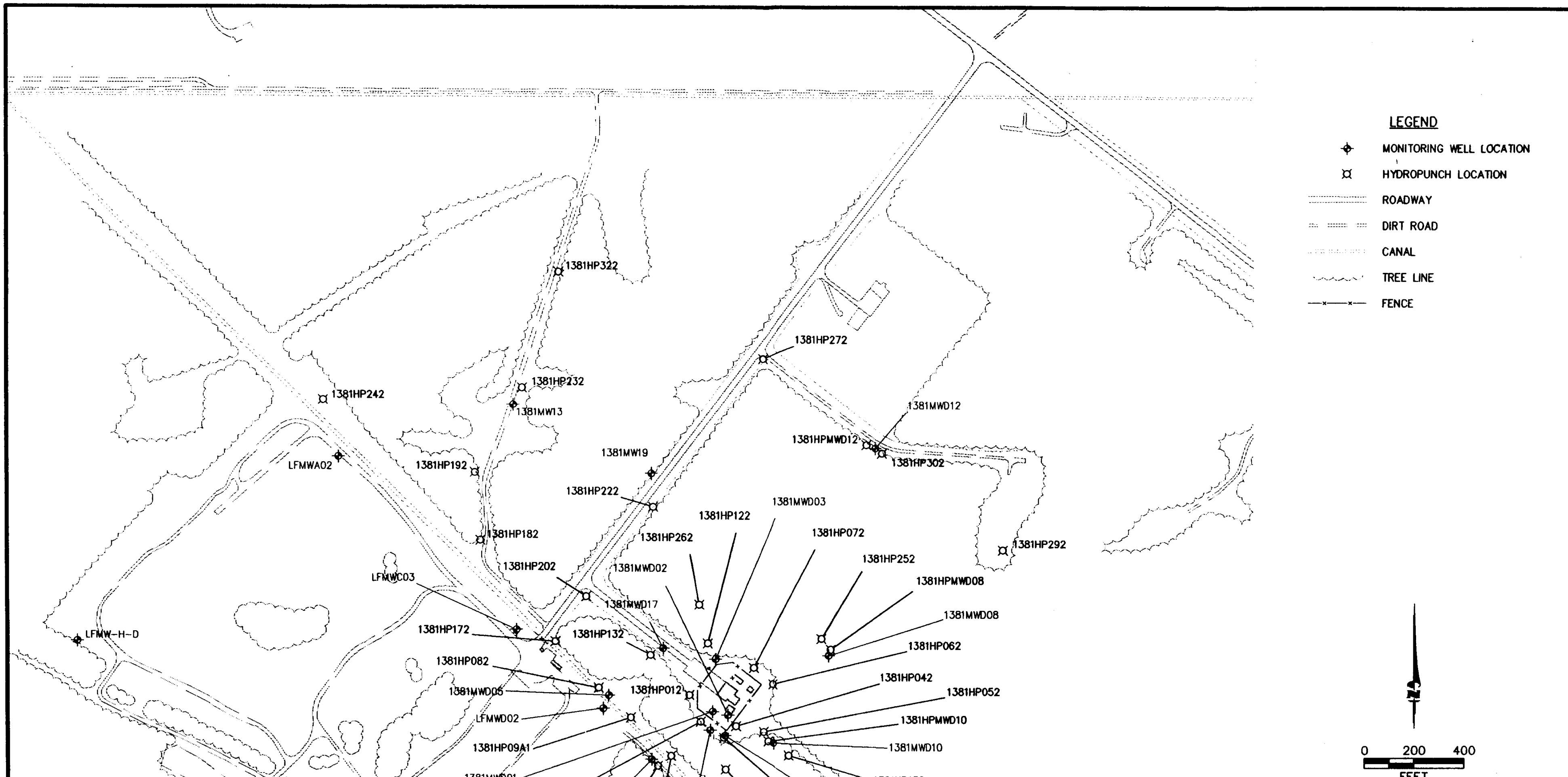

FIGURE 2.5

DEEP MONITORING WELL AND HYDROPUNCH LOCATIONS

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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TABLE 2.1
MONITORING WELL CONSTRUCTION DETAILS
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Well Location	Installation Date	Northing (ft)	Easting (ft)	Well ID (inches)	Datum Elevation (ft msl)[a]	Ground Elevation (ft msl)	Screen Interval Top (ft bgs)[b]	Screen Interval Bottom (ft bgs)
1381[c]-MWS[d]01	11/30/93	1504383.31	797422.99	2.00	9.08	9.17	5.00	15.00
1381-MWD[e]01	11/30/93	1504379.31	797428.44	2.00	9.04	9.17	38.00	48.00
1381-MWS02	12/1/93	1504368.77	797491.99	2.00	9.14	9.30	5.00	15.00
1381-MWD02	9/22/95	1504365.49	797489.60	2.00	9.15	9.30	46.00	51.00
1381-MWS03	12/8/95	1504588.46	797436.66	2.00	8.38	8.24	3.00	13.00
1381-MWD03	1/25/96	1504588.38	797440.25	2.00	8.30	8.24	46.50	51.50
1381-MWD04	1/25/96	1504305.43	797418.48	2.00	12.23	9.52	72.50	77.50
1381-MWS05	1/29/96	1504447.00	797005.30	2.00	11.18	7.68	3.00	13.00
1381-MWI05	1/25/96	1504452.00	797001.80	2.00	11.28	7.68	30.00	35.00
1381-MWD05	1/21/96	1504444.11	797009.79	2.00	10.32	7.68	44.00	49.00
1381-MWS06	1/21/96	1504466.00	797024.70	2.00	10.69	7.68	3.00	13.00
1381-MWS07	1/21/96	1505755.00	797602.10	2.00	10.20	NA[f]	3.00	13.00
1381-MWS08	3/2/96	1504609.52	797903.21	2.00	9.76	7.17	3.00	13.00
1381-MWD08	5/17/96	1504603.00	797900.19	2.00	10.08	7.38	43.00	48.00
1381-MWS09	3/3/96	1504278.21	797469.30	2.00	7.14	7.45	7.50	12.50
1381-MWI09	2/27/96	1504272.57	797478.96	2.00	6.77	7.22	30.00	35.00
1381-MWD09	3/2/96	1504275.71	797474.19	2.00	7.05	7.14	44.80	49.80
1381-MWS10	2/28/96	1504258.18	797671.13	2.00	10.55	7.97	3.00	13.00
1381-MWD10	2/28/96	1504254.48	797674.51	2.00	10.84	7.97	44.50	49.50
1381-MWS11	3/3/96	1504193.92	797178.06	2.00	10.86	8.08	4.00	14.00
1381-MWD11	3/4/96	1504188.81	797182.42	2.00	10.96	8.33	44.50	49.50
1381-MWS12	3/13/96	1505429.89	798083.35	2.00	9.62	6.88	3.00	13.00
1381-MWD12	3/12/96	1505427.46	798088.61	2.00	9.60	6.96	44.00	49.00
1381-MWS13	3/12/96	1505592.71	796624.10	2.00	10.91	8.24	2.50	12.50
1381-MWD13	3/19/96	1505601.33	796626.89	2.00	10.85	8.62	44.50	49.50
1381-MWS14	3/12/96	1506002.99	798494.39	2.00	8.24	8.23	4.00	14.00
1381-MWS15	5/20/96	1506601.74	798915.22	2.00	10.44	7.79	3.00	13.00
1381-MWS16	5/18/96	1505363.75	798696.50	2.00	10.08	7.81	3.00	13.00
1381-MWS17	5/18/96	1504627.62	797234.30	2.00	8.51	8.70	4.80	14.80
1381-MWD17	5/17/96	1504631.56	797229.40	2.00	8.48	8.72	45.50	50.50
1381-MWS18	5/19/96	1504099.04	797568.54	2.00	9.16	6.65	2.50	12.50
1381-MWD19	5/19/96	1505327.27	797182.71	2.00	7.86	5.29	44.50	49.50
1381-PZ01	NA	1504087.54	797374.32	2.00	10.29	8.12	2.50	12.50
1381-PZ02	NA	1504101.25	797389.02	2.00	10.39	7.66	2.50	12.50
1381-PZ03	NA	1506395.65	796890.28	2.00	11.75	8.97	2.50	12.50
LFMW-1[g] old	NA	1502840.56	797178.48	2.00	12.22	8.96	NA	NA
LFMW-4 old	NA	1504351.08	795173.14	NA	13.78	10.21	NA	NA
LFMW-5 old	NA	1506332.98	794385.85	4.00	8.46	7.31	NA	NA
LFMW-6 old	NA	1505631.78	793395.05	3.00	7.91	6.74	NA	NA
LFMW-7 old	NA	1505050.36	796313.77	NA	10.91	8.12	NA	NA
LFMW-A-S (LF-MWA01)	NA	1505400.64	795920.54	4.00	13.47	10.99	NA	NA
LFMW-A-D (LF-MWA02)	NA	1505393.49	795926.75	4.00	13.44	10.93	NA	NA
LFMW-B-S (MWB01)	NA	1505057.93	796286.79	4.00	11.83	9.35	NA	NA
LFMW-B-I (LF-MWB02)	NA	1505049.73	796293.74	4.00	11.59	9.25	NA	NA
LFMW-C-S (LF-MWC01)	NA	1504717.53	796627.80	4.00	11.24	8.83	NA	NA

TABLE 2.1
MONITORING WELL CONSTRUCTION DETAILS
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Well Location	Installation Date	Northing (ft)	Easting (ft)	Well ID (inches)	Datum Elevation (ft msl)[a/]	Ground Elevation (ft msl)	Screen Interval Top (ft bgs)[b/]	Screen Interval Bottom (ft bgs)
LFMW-C-I (LF-MWC02)	NA	1504711.76	796633.73	4.00	11.33	8.85	NA	NA
LFMW-C-D (LF-MWC03)	NA	1504705.82	796639.42	4.00	11.16	8.88	NA	NA
LFMW-D-S (LF-MWD01)	NA	1504397.11	796981.65	4.00	10.49	7.89	NA	NA
LFMW-D-D (LF-MWD02)	NA	1504391.41	796988.05	4.00	10.67	8.03	NA	NA
LFMW-E-S (LFE03)	NA	1503309.74	796348.25	4.00	12.26	9.32	NA	NA
LFMW-E-I (LFE02)	NA	1503306.69	796353.29	4.00	12.02	9.27	NA	NA
LFMW-E-D (LFE01)	NA	1503304.30	796358.15	4.00	11.87	9.01	NA	NA
LFMW-F-S	NA	1505359.72	795235.47	4.00	11.63	8.47	NA	NA
LFMW-G-S	NA	1504937.99	794839.62	4.00	11.84	9.16	NA	NA
LFMW-H-S	NA	1504672.65	794888.86	4.00	11.54	8.20	NA	NA
LFMW-H-I	NA	1504665.42	794886.38	4.00	11.18	8.41	NA	NA
LFMW-H-D	NA	1504658.13	794884.20	4.00	10.76	8.61	NA	NA
LFMW-I-S	NA	1504360.77	795091.71	4.00	14.93	11.91	NA	NA
LFMW-J-S	NA	1504052.61	795640.47	4.00	12.06	9.14	NA	NA
LFMW-K-S	NA	1503528.31	796256.00	4.00	10.50	8.11	NA	NA

[a/] ft msl = feet above mean sea level.

[b/] ft bgs = feet below ground surface.

[c/] The number 1381 identifies wells/piezometers located within the perimeter of Facility 1381.

[d/] The letter S identifies wells/piezometers which are screened shallow within the surficial aquifer.

[e/] The letter D identifies wells/piezometers which are screened deep within the surficial aquifer.

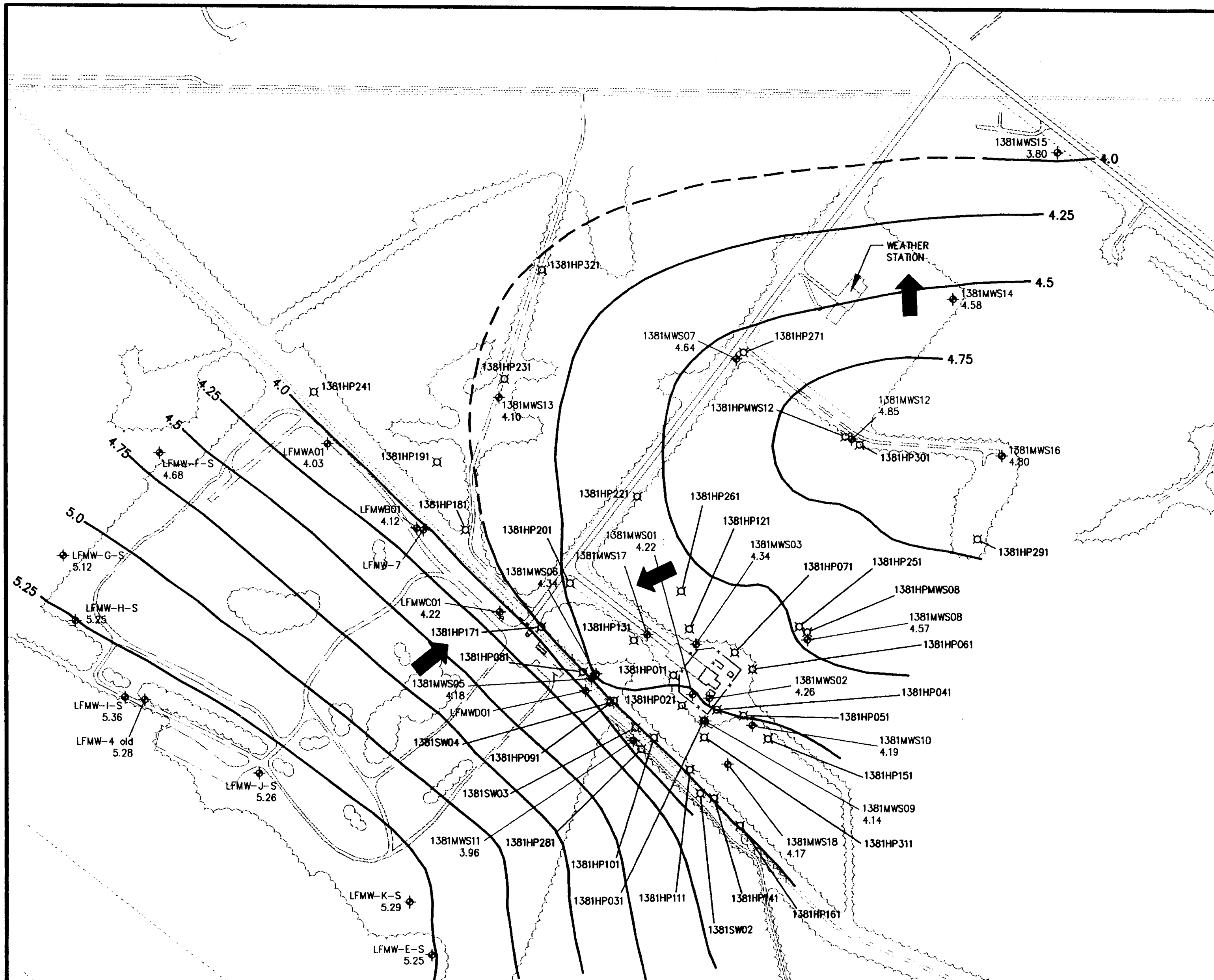
[f/] NA = data not available.

[g/] The identifier LFMW indicates monitoring wells located in adjacent landfill site to the southwest of Facility 1381.

TABLE 2.2
HYDROPUNCH® SAMPLING LOCATIONS
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Hydropunch Location	Sample Date	Sample Depth Shallow (ft msl)[a/]	Sample Depth Deep (ft msl)	Maximum Sample Depth (ft msl)	Borehole Depth (ft msl)
1381 - HP01	10/30/95	12.5	47	47	47
1381 - HP02	10/31/95	12	47	47	47
1381 - HP03	10/31/95	11	47	47	47
1381 - HP04	11/1/95	11	46	46	46
1381 - HP05	11/15/95	10	46	46	46
1381 - HP06	11/16/95	10	46	46	46
1381 - HP07	11/16/95	10	46	46	46
1381 - HP08	11/27/95	11	46	46	46
1381 - HP09	11/17/95	11	NA[b/]	11	48
1381 - HP09A	12/1/95	NA	43	43	43
1381 - HP10	11/17/95	11	46	46	46
1381 - HP11	11/17/95	11	46	46	46
1381 - HP12	11/27/95	10	43	43	43
1381 - HP13	12/15/95	11	46	46	46
1381 - HP14	12/1/95	10	43	43	43
1381 - HP15	12/2/95	10	43	43	43
1381 - HP16	12/5/95	10	43	43	43
1381 - HP17	12/5/95	10	43	43	43
1381 - HP18	12/15/95	11	46	46	51
1381 - HP19	12/21/95	11	46	46	46
1381 - HP20	12/21/95	11	46	46	46
1381 - HP22	1/11/96	11	46	46	46
1381 - HP23	1/11/96	11	46	46	46
1381 - HP24	1/11/96	13	43	43	43
1381 - HP25	1/19/96	11	46	46	46
1381 - HP26	1/19/96	11	46	46	46
1381 - HP27	1/23/96	11	43	43	43
1381 - HP28	1/23/96	11	46	46	46
1381 - HP29	1/23/96	11	46	46	46
1381 - HP30	1/24/96	11	43	43	43
1381 - HP31	1/24/96	11	46	46	46
1381 - HP32	1/25/96	11	43	43	43

a/ ft msl = feet above mean-sea-level.
b/ NA = data not available



LEGEND

- SHALLOW SURFICIAL MONITORING WELL LOCATION
- HYDROPUNCH LOCATION
- 4.5 GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- ROADWAY
- DIRT ROAD
- CANAL
- TREE LINE
- FENCE
- DIRECTION OF GROUNDWATER FLOW

N

0 200 400
FEET

FIGURE 2.6

GROUNDWATER TABLE ELEVATION MAP OF SHALLOW SURFICIAL AQUIFER JUNE 1996

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS ENGINEERING SCIENCE, INC.

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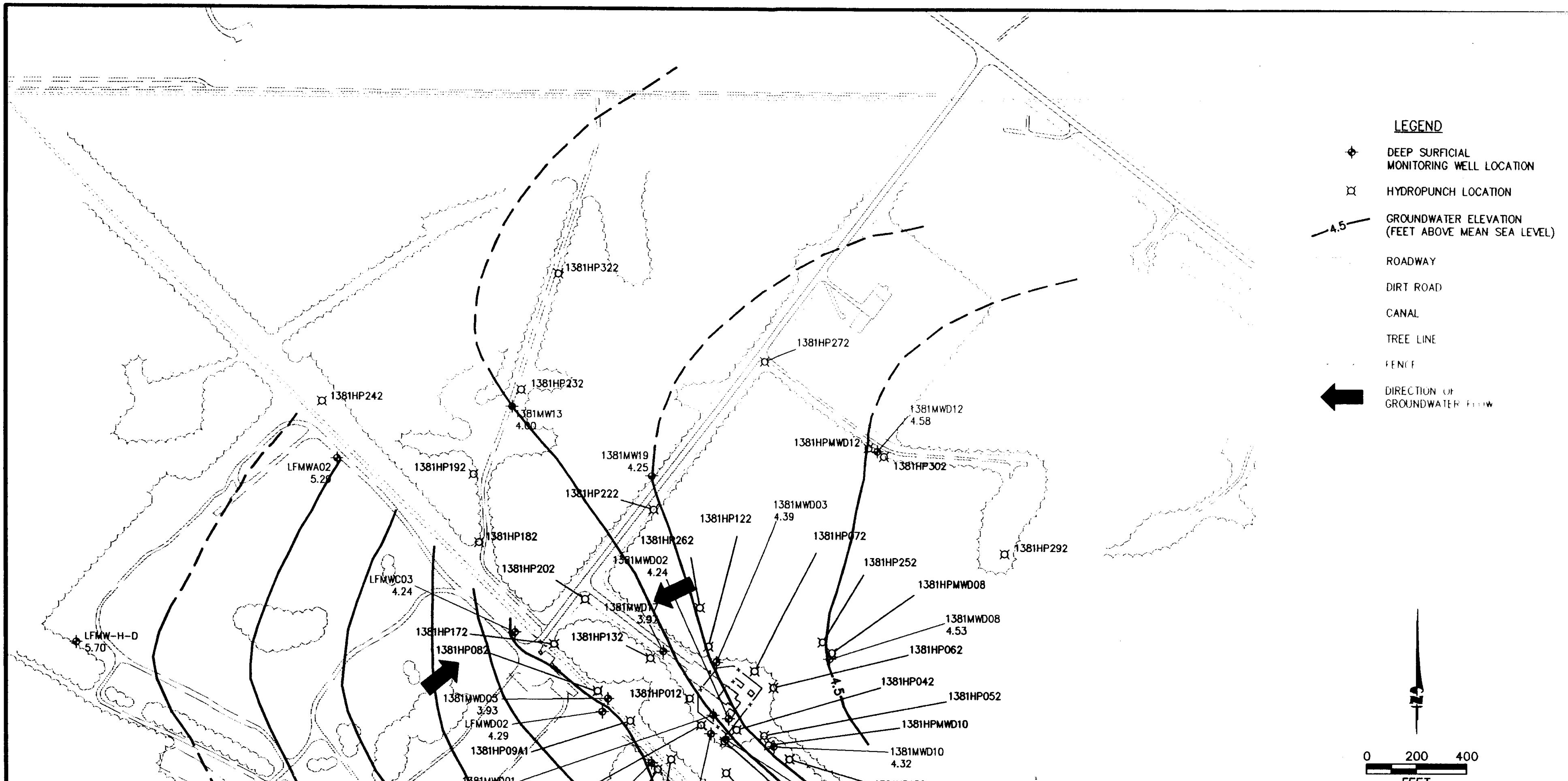

FIGURE 2.7

POTENTIOMETRIC SURFACE MAP OF DEEP SURFICIAL AQUIFER JUNE 1996

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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TABLE 2.3
GROUNDWATER ELEVATIONS
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Monitoring Well	1/5/95 (ft btoc[a/])	1/5/95 (ft msl[b/])	8/28/95 (ft btoc)	8/28/95 (ft msl)	1/30/96 (ft btoc)	1/30/96 (ft msl)	3/4/96 (ft btoc)	3/4/96 (ft msl)	3/12/96 (ft btoc)	3/12/96 (ft msl)	4/4/96 (ft btoc)	4/4/96 (ft msl)	6/19/96 (ft btoc)	6/19/96 (ft msl)
1381-MWS[c/]01	6.33	2.75	4.95	4.13	6.6	2.48	6.5	2.58	4.78	4.3	4.58	4.5	4.86	4.22
1381-MWD[d/]01	6.31	2.73	5.13	3.91	6.55	2.49	6.43	2.61	4.84	4.2	4.61	4.43	4.97	4.07
1381-MWS02	6.38	2.76	4.97	4.17	6.65	2.49	6.55	2.59	4.81	4.33	4.62	4.52	4.88	4.26
1381-MWD02	6.42	2.73	NA[e/]	NA	6.68	2.47	6.53	2.62	4.86	4.29	4.61	4.54	4.91	4.24
1381-MWS03	5.61	2.77	NA	NA	5.88	2.5	5.8	2.58	4.04	4.34	3.82	4.56	4.04	4.34
1381-MWD03	5.65	2.65	NA	NA	5.81	2.49	5.71	2.59	4.13	4.17	3.75	4.55	3.91	4.39
1381-MWD04	2.15	10.08	NA	NA	2.42	9.81	2.59	9.64	2.27	9.96	2.05	10.18	2.31	9.92
1381-MWS05	NA	NA	NA	NA	8.49	2.69	NA	NA	6.69	4.49	6.55	4.63	7	4.18
1381-MWI05	NA	NA	NA	NA	8.51	2.77	NA	NA	6.27	5.01	6.61	4.67	7.04	4.24
1381-MWD05	NA	NA	NA	NA	NA	NA	NA	NA	6.84	3.48	5.96	4.36	6.39	3.93
1381-MWS06	NA	NA	NA	NA	7.9	2.79	NA	NA	6.27	4.42	5.94	4.75	6.35	4.34
1381-MWS07	NA	NA	NA	NA	7.38	2.82	7.41	2.79	5.67	4.53	5.28	4.92	5.56	4.64
1381-MWS08	NA	NA	NA	NA	NA	NA	7.22	2.54	5.36	4.4	5.07	4.69	5.19	4.57
1381-MWD08	NA	NA	NA	NA	NA	NA	8.08	2	6.05	4.03	5.38	4.7	5.55	4.53
1381-MWS09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.71	4.43	3	4.14
1381-MWI09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.66	4.11
1381-MWD09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.44	3.61	3.54	3.51
1381-MWS10	NA	NA	NA	NA	NA	NA	8.46	2.09	6.38	4.17	6.15	4.4	6.36	4.19
1381-MWD10	NA	NA	NA	NA	NA	NA	8.63	2.21	7.57	3.27	6.31	4.53	6.52	4.32
1381-MWS11	NA	NA	NA	NA	NA	NA	NA	NA	6.72	4.14	6.51	4.35	6.9	3.96
1381-MWD11	NA	NA	NA	NA	NA	NA	NA	NA	7.00	3.96	6.62	4.34	NA	NA
1381-MWS12	NA	NA	NA	NA	NA	NA	NA	NA	5.05	4.57	4.71	4.91	4.77	4.85
1381-MWD12	NA	NA	NA	NA	NA	NA	NA	NA	5.09	4.51	4.63	4.97	5.02	4.58
1381-MWS13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.5	4.41	6.81	4.1
1381-MWD13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.21	4.64	6.85	4
1381-MWS14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.5	4.74	3.66	4.58
1381-MWS15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.27	4.17	6.64	3.8
1381-MWS16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.28	4.8

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TABLE 2.3 (continued)
GROUNDWATER ELEVATIONS
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Monitoring Well	1/5/95 (ft btoc[a/])	1/5/95 (ft msl[b/])	8/28/95 (ft btoc)	8/28/95 (ft msl)	1/30/96 (ft btoc)	1/30/96 (ft msl)	3/4/96 (ft btoc)	3/4/96 (ft msl)	3/12/96 (ft btoc)	3/12/96 (ft msl)	4/4/96 (ft btoc)	4/4/96 (ft msl)	6/19/96 (ft btoc)	6/19/96 (ft msl)
1381-MWS17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.28	4.23
1381-MWD17	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.51	3.97
1381-MWS18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.99	4.17
1381-MWD19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.61	4.25
1381-PZ01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.38	3.91
1381-PZ02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.42	3.97
1381-PZ03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.84	3.91
MW0STAFF2	1.99	2.51	NA	NA	1.78	2.3	NA	NA	3.39	3.91	3.64	NA	NA	NA
MW0STAFF3	2.09	2.64	NA	NA	1.88	2.43	NA	NA	3.56	4.11	3.8	NA	NA	NA
STILLING GAUGE	NA	NA	NA	NA	3.94	1.96	NA	NA	2.80	3.1	1.56	4.34	NA	NA
LFMW-1 old	9	3.22	NA	NA	9.26	2.96	9.31	2.91	7.57	4.65	7.15	5.07	7.01	5.21
LFMW-4 old	10.23	3.55	NA	NA	10.54	3.24	10.64	3.14	9.30	4.48	8.28	5.5	8.5	5.28
LFMW-5 old	5.22	3.24	NA	NA	5.47	2.99	5.51	2.95	3.70	4.76	3.56	4.9	3.94	4.52
LFMW-6 old	4.04	3.87	NA	NA	4.37	3.54	4.51	3.4	2.87	5.04	3.12	4.79	3.45	4.46
LFMW-7 old	8.32	2.59	NA	NA	8.54	2.37	8.38	2.53	6.91	4	6.6	4.31	7.1	3.81
LFMW-A-S (LF-MWA01)	10.64	2.83	NA	NA	10.85	2.62	10.72	2.75	9.23	4.24	8.95	4.52	9.44	4.03
LFMW-A-D (LF-MWA02)	10.46	2.98	NA	NA	10.34	3.1	10.44	3	9.57	3.87	8.59	4.85	8.15	5.29
LFMW-B-S (MWB01)	8.98	2.85	NA	NA	9.17	2.66	9.02	2.81	7.53	4.3	7.24	4.59	7.71	4.12
LFMW-B-I (LF-MWB02)	8.78	2.81	NA	NA	8.98	2.61	8.83	2.76	7.33	4.26	7.02	4.57	7.48	4.11
LFMW-C-S (LF-MWC01)	8.31	2.93	NA	NA	8.55	2.69	8.39	2.85	6.88	4.36	6.58	4.66	7.02	4.22
LFMW-C-I (LF-MWC02)	8.31	3.02	NA	NA	8.54	2.79	8.4	2.93	6.88	4.45	6.58	4.75	7.01	4.32
LFMW-C-D (LF-MWC03)	8.24	2.92	NA	NA	8.41	2.75	8.35	2.81	6.83	4.33	6.47	4.69	6.92	4.24
LFMW-D-S (LF-MWD01)	7.54	2.95	NA	NA	7.79	2.7	7.58	2.91	6.09	4.4	5.84	4.65	6.24	4.25
LFMW-D-D (LF-MWD02)	7.68	2.99	NA	NA	7.91	2.76	7.78	2.89	6.37	4.3	6.02	4.65	6.38	4.29
LFMW-E-S (LFE03)	8.99	3.27	NA	NA	9.25	3.01	NA	NA	NA	NA	7.13	5.13	7.01	5.25
LFMW-E-I (LFE02)	8.73	3.29	NA	NA	8.97	3.05	9.05	2.97	7.33	4.69	6.88	5.14	6.75	5.27
LFMW-E-D (LFE01)	8.67	3.2	NA	NA	8.91	2.96	8.97	2.9	7.27	4.6	6.8	5.07	6.69	5.18
LFMW-F-S	8.35	NA	NA	NA	8.65	2.98	8.65	2.98	7.04	4.59	6.61	5.02	6.95	4.68

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TABLE 2.3 (continued)
GROUNDWATER ELEVATIONS
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Monitoring Well	1/5/95 (ft btoc[a/])	1/5/95 (ft msl[b/])	8/28/95 (ft btoc)	8/28/95 (ft msl)	1/30/96 (ft btoc)	1/30/96 (ft msl)	3/4/96 (ft btoc)	3/4/96 (ft msl)	3/12/96 (ft btoc)	3/12/96 (ft msl)	4/4/96 (ft btoc)	4/4/96 (ft msl)	6/19/96 (ft btoc)	6/19/96 (ft msl)
LFMW-G-S	8.24	NA	NA	NA	8.6	3.24	8.71	3.13	7.01	4.83	6.49	5.35	6.72	5.12
LFMW-H-S	7.89	NA	NA	NA	8.25	3.29	8.38	3.16	6.73	4.81	6.07	5.47	6.29	5.25
LFMW-H-I	7.57	NA	NA	NA	7.92	3.26	8.05	3.13	6.42	4.76	5.75	5.43	5.94	5.24
LFMW-H-D	7.46	NA	NA	NA	7.09	3.67	7.69	3.07	7.11	3.65	5.72	5.04	5.06	5.7
LFMW-I-S	11.32	NA	NA	NA	11.61	3.32	11.75	3.18	10.30	4.63	9.37	5.56	9.57	5.36
LFMW-J-S	8.63	NA	NA	NA	8.91	3.15	8.99	3.07	7.50	4.56	6.7	5.36	6.8	5.26
LFMW-K-S	7.19	NA	NA	NA	7.5	3	7.54	2.96	5.72	4.78	5.33	5.17	5.21	5.29

[a/] ft btoc = feet below top of casing.
[b/] ft msl = feet above mean sea level.
[c/] The S identifies wells/piezometers which are screened shallow within the surficial aquifer.
[d/] The D identifies wells/piezometers which are screened deep within the surficial aquifer.
[e/] NA = data not available.

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The intermediate/deeper surficial aquifer generally follows the same groundwater flow pattern toward the landfill canal (Figure 2.7), but there are no deeper wells northwest of the weather station to confirm that the groundwater divide in the vicinity of the weather station affects deeper flows.

On the basis of June 1996 groundwater level measurements, the average groundwater gradients to the south and north of the groundwater divide were approximately 0.00054 foot/foot (ft/ft) to the southwest and 0.00096 ft/ft to the north, respectively. The groundwater gradient in the landfill area was 0.0010 ft/ft to the northeast, toward the drainage canal adjacent to Facility 1381 (Figure 2.6). Nested well pairs screened in shallow and deeper portions of the surficial aquifer indicate a downward vertical hydraulic gradient (8 of 10 nested well pairs) with occasional upward gradients (2 of 10 nested well pairs). The maximum downward gradient was 0.0172 ft/ft at nested well location 1381MW09. The maximum upward gradient was 0.0033 ft/ft at nested well location 1381MW10.

The advective velocity of groundwater in the direction parallel to groundwater flow is given by:

$$v = \frac{K}{n_e}\frac{dH}{dL}$$

Where: $\bar{v}$ = Average advective groundwater velocity (seepage velocity) [L/T]

K=Hydraulic conductivity [L/T]

dH/dL=Gradient [L/L]

n_e=Effective porosity.

Assuming an average hydraulic conductivity of 2.83 feet per day (ft/day), or 10^{-3} centimeters per second (cm/sec); an effective porosity of 0.25; and the gradients given above, the average advective groundwater velocities are 0.006 ft/day at the site south of the groundwater divide, and 0.011 ft/day north of the groundwater divide. These calculated velocities appear to be very low, and suggest that groundwater would take many centuries to travel several hundred feet. The estimated hydraulic conductivity of 2.83 ft/day for the site was derived from literature for fine sands (Freeze & Cherry, 1979). Groundwater velocities at the site may be higher because hydraulic conductivities may be greater than literature values. Furthermore, fluctuating groundwater flow directions caused by changing surface water elevations in drainage canals could increase groundwater gradients. Slug tests will be performed at the site to better define actual hydraulic conductivities at the site (Section 3).

2.1.3 Nature and Extent of Contamination at Facility 1381

The following sections are derived from data to be presented in the draft CMS report for Facility 1381 (Parsons ES, in preparation). Groundwater data from the hydropunch® and monitoring well locations were combined to better define the vertical

and horizontal extent of contamination. Data used in the preparation of this report are summarized in Appendix A.

2.1.3.1 Soil/Sediment Contamination

Thirty shallow soil samples have been collected in support of the CMS at Facility 1381. Soil samples were collected from depths of no more than 4 feet bgs during monitoring well installation. Appendix A contains available soil data. No VOCs, CAHs, or semivolatile organic compounds (SVOCs) were detected above analytical reporting limits. The highest detected contaminant concentration was fluoranthene detected in soil sample 1381SBA08 at 0.28 milligram per kilogram (mg/kg).

Seven locations were sampled for sediment contamination at Facility 1381 between December 1995 and March 1996. Figure 2.8 shows the location of these sediment samples. Appendix A contains available sediment sample data. Six of the seven sediment samples collected were located along the northwest-flowing canal 300 feet to the southwest of Facility 1381, and one was collected northwest of the facility. Sediment samples had very low concentrations of VOCs, CAHs, and SVOCs, and most concentrations were below reportable limits. The highest detected contaminant concentration in a sediment sample was 0.032 mg/kg total 1,2-dicloroethene (1,2-DCE) at sediment sampling location 1381SE03 (along the most contaminated groundwater discharge segment of the canal). Contaminants do not appear to be accumulating within drainage canal sediments.

2.1.3.2 Groundwater/Surface Water Contamination

Figures 2.4 and 2.5 show groundwater monitoring well and hydropunch® sampling locations at Facility 1381. Sampling of groundwater monitoring wells at the site has indicated that concentrations of volatile organic halocarbons (VOHs), which include CAHs, were elevated in many wells at the site, specifically near the southwestern corner of the fenced area surrounding Facility 1381. Accidental releases of TCE through improper drum storage practices are suspected to have occurred in the general vicinity. Groundwater data collected from monitoring wells detected only double-bonded CAHs (e.g., TCE, 1,2-DCE); no single-bonded CAHs (e.g., 1,1-DCA, 1,2-DCA) were detected. hydropunch® data collected from November 1995 to March 1996 detected both single- and double-bonded CAHs. Benzene, toluene, ethylbenzene, and xylenes (BTEX) and SVOC compounds were detected in only trace concentrations. CAHs are the dominant contaminant type detected in shallow, intermediate, and deep monitoring wells at the site. Table 2.4 lists BTEX and double bonded CAHs detected at the site.

Figures 2.9 and 2.10 show total chlorinated compounds at Facility 1381 in the shallow and deep portions of the surficial aquifer. The sum of total chlorinated compounds is defined as the sum of the three most common CAHs detected at the site: TCE, 1,2-DCE, and vinyl chloride (VC). The total chlorinated VOC plume in the shallow portion of the aquifer measures approximately 3,000 feet in the northeast/southwest direction and 2,200 feet in the northwest/southeast direction. As

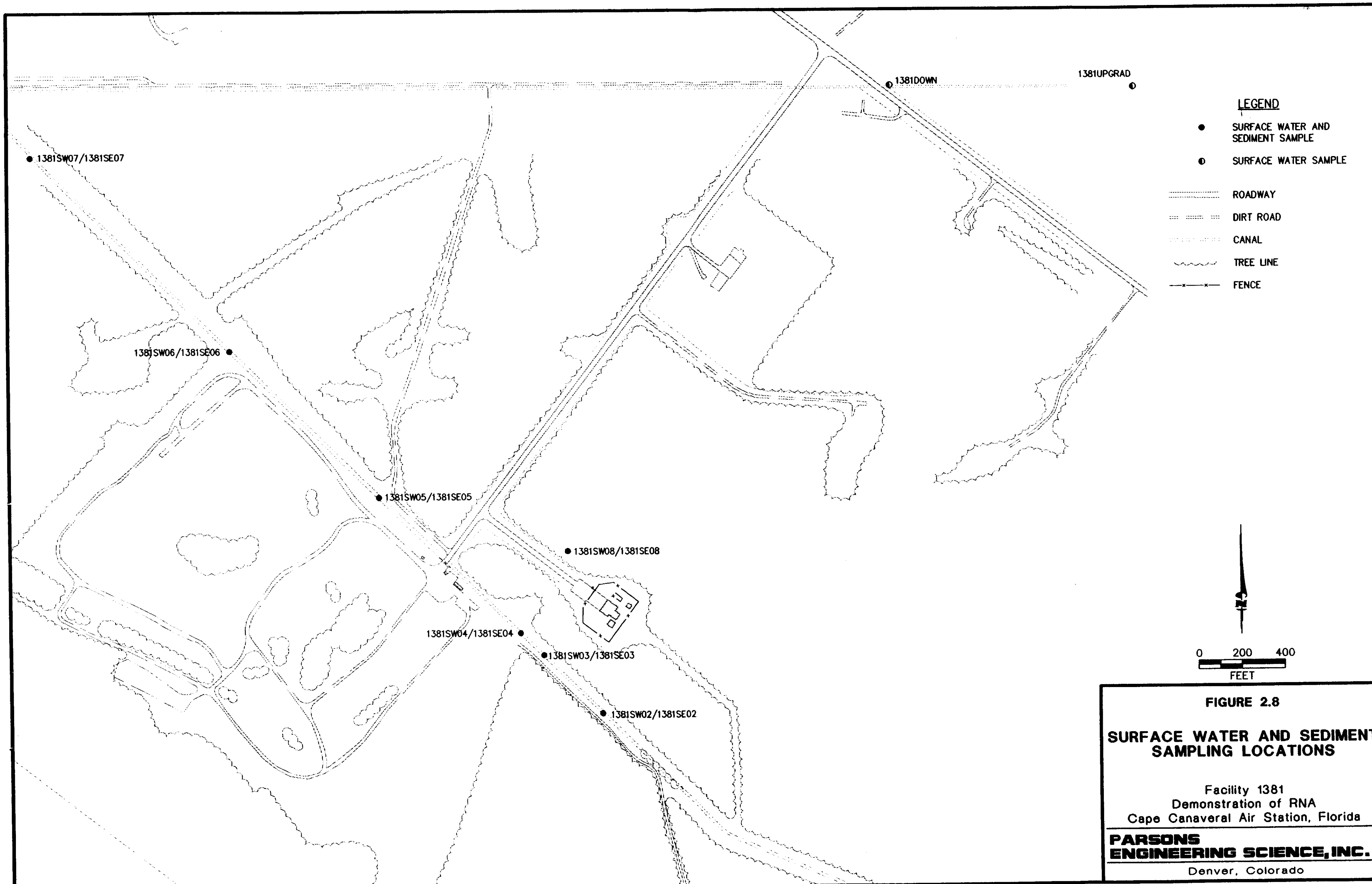

FIGURE 2.8

SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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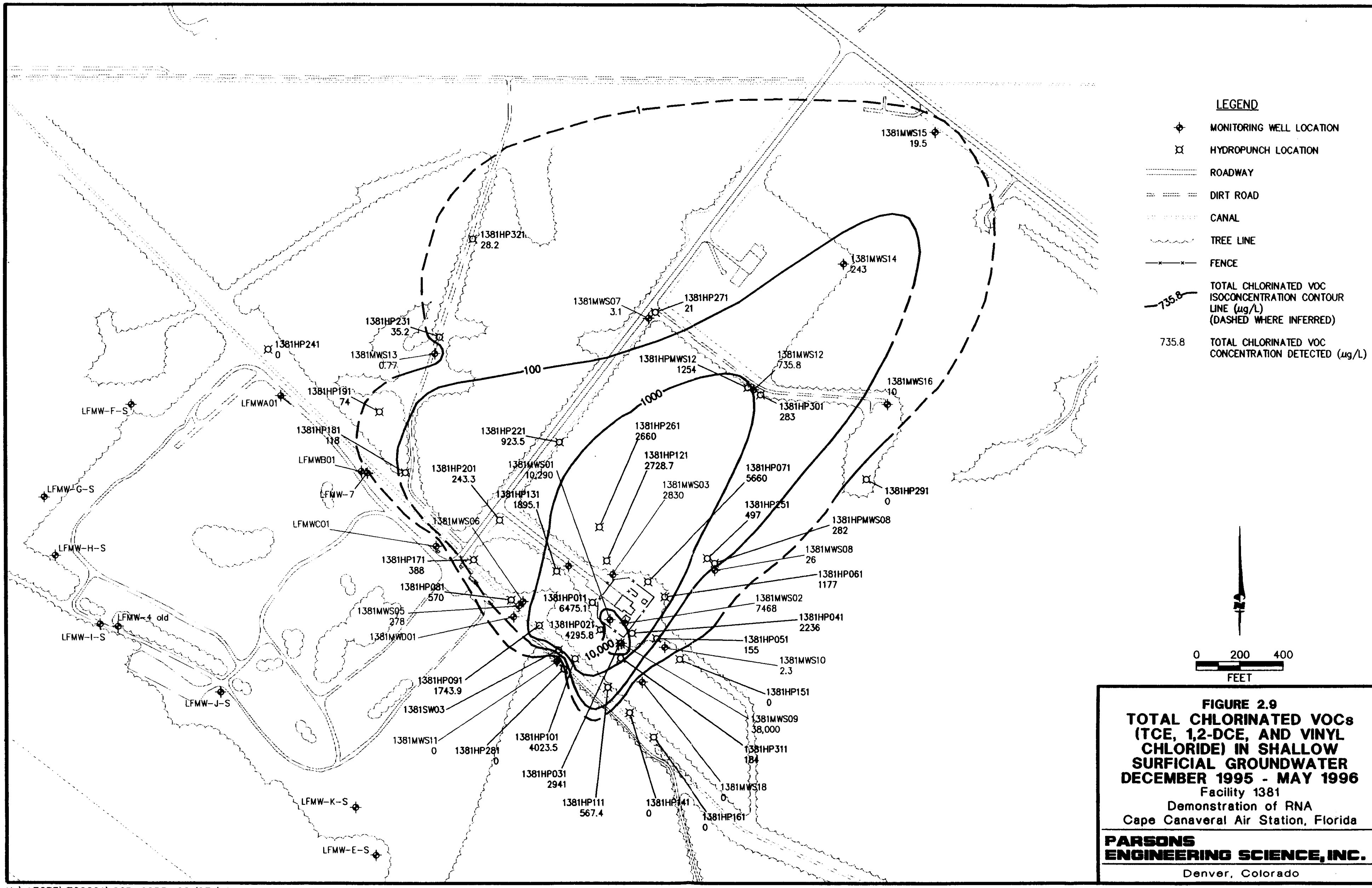

FIGURE 2.9
TOTAL CHLORINATED VOCs (TCE, 1,2-DCE, AND VINYL CHLORIDE) IN SHALLOW SURFICIAL GROUNDWATER DECEMBER 1995 - MAY 1996
Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

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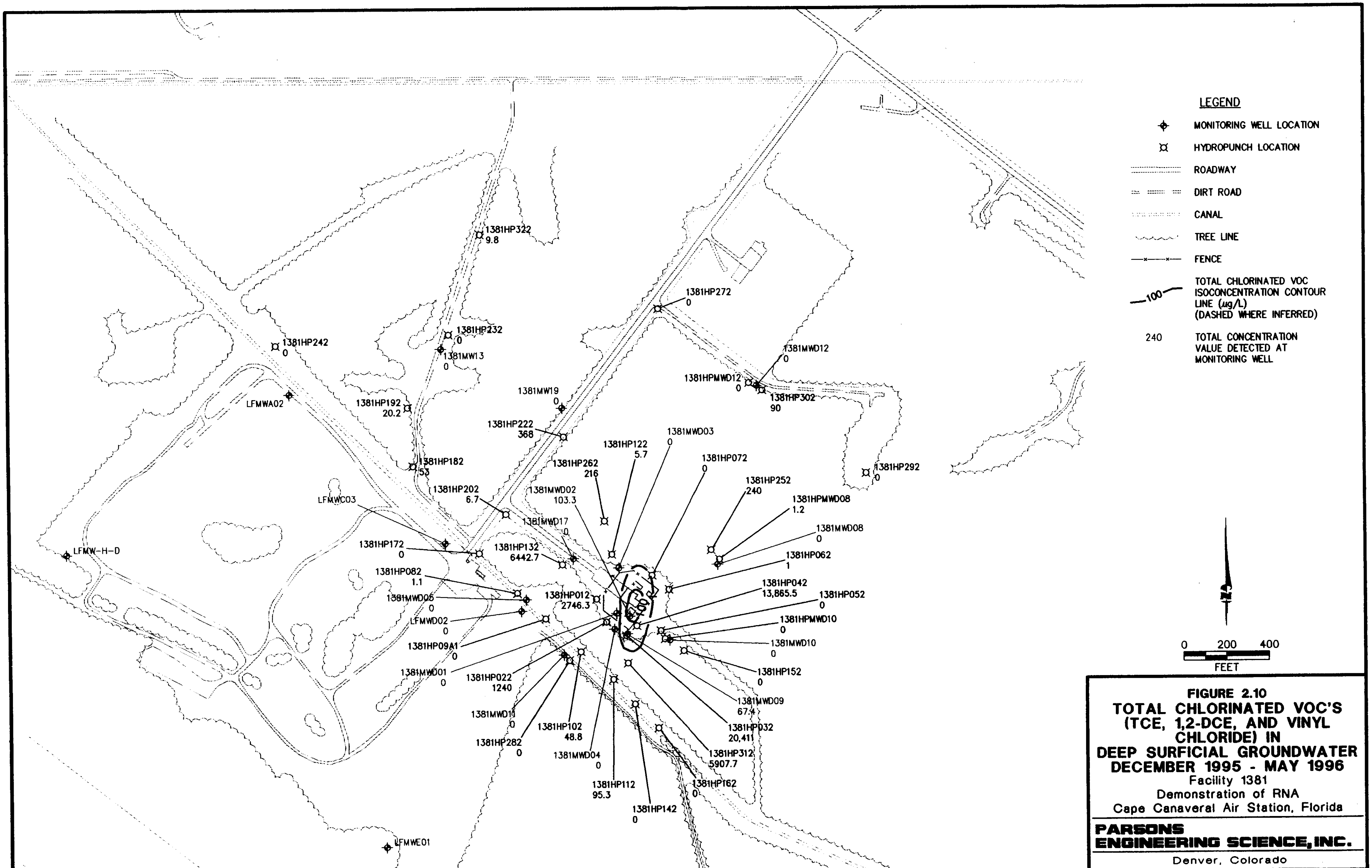

FIGURE 2.10
TOTAL CHLORINATED VOC'S (TCE, 1,2-DCE, AND VINYL CHLORIDE) IN DEEP SURFICIAL GROUNDWATER DECEMBER 1995 - MAY 1996
Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

TABLE 2.4
BTEX AND CHLORINATED VOCs DETECTED IN GROUNDWATER
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Sample Location	Sample Collection	Benzene (μg/L)[a]	Toluene (μg/L)	Ethyl-benzene (μg/L)	Xylenes (μg/L)	Total BTEX (μg/L)	TCE (μg/L)	1,1-DCE (μg/L)	Trans-1,2-DCE (μg/L)	Total-1,2-DCE (μg/L)	Vinyl Chloride (μg/L)	Total Chl. VOCs (μg/L)
Monitoring Wells - Shallow												
1381MWS[b]01	12/15/95	ND[c]	ND	ND	ND	ND	190F[d]	ND	ND	8800	1300	10290
1381MWS02	12/15/95	ND	ND	ND	ND	ND	4300	68F	ND	3000	100F	7468
1381MWS03	12/15/95	ND	ND	ND	ND	ND	ND	ND	ND	2500	330	2830
1381HPMWS12	3/3/96	ND	ND	ND	ND	ND	ND	ND	14	984	270	1254
1381MWS05	3/13/96	ND	ND	ND	ND	ND	ND	ND	3.3F	180J[e]	98J	278
1381MWS07	3/22/96	ND	ND	ND	ND	ND	ND	ND	ND	3.1	ND	3.1
1381HPMWS08	2/21/96	ND	ND	ND	ND	ND	ND	ND	ND	210	72	282
1381MWS10	3/12/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.3	2.3
1381MWS11	3/12/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWS12	NA[f]	ND	ND	ND	ND	ND	ND	ND	5.8	605.8	130	735.8
1381MWS13	3/22/96	ND	ND	ND	ND	ND	ND	ND	ND	0.77F	ND	0.77
1381MWS14	NA	1.3	ND	ND	ND	1.3	ND	ND	ND	211	32	243
1381MWS15	3/22/96	ND	ND	ND	ND	ND	ND	ND	ND	18	1.5F	19.5
1381MWS08	3/8/96	ND	ND	ND	ND	ND	ND	ND	ND	14	12J	26
1381MWS16	5/24/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	10
1381MWS17	5/22/96	ND	ND	ND	ND	ND	3.7	ND	1030	15	890	908.7
1381MWS18	5/21/96	1.1	1.2	ND	ND	2.3	ND	ND	ND	ND	ND	ND
1381MWS09	3/8/96	ND	ND	ND	ND	ND	35000	ND	ND	3000	ND	38000
Monitoring Wells - Intermediate												
1381MWI[g]05	3/13/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWI09	5/22/96	ND	ND	ND	ND	ND	1880	24	320	2380	420	4704
Monitoring Wells - Deep												
1381MWD[h]01	12/15/95	ND	ND	ND	3.5	3.5	ND	ND	ND	ND	ND	ND
1381MWD02	12/15/95	ND	ND	ND	ND	ND	3.3	ND	ND	38J	62	103.3
1381MWD03	12/15/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWD05	3/13/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HPMWD08	2/21/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	1.2
1381MWD10	3/12/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWD11	3/12/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWD12	3/13/96	ND	3.8	ND	ND	3.8	ND	ND	ND	ND	ND	ND

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TABLE 2.4 (continued)
BTEX AND CHLORINATED VOCs DETECTED IN GROUNDWATER
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Sample Location	Sample Collection	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	TCE (µg/L)	1,1-DCE (µg/L)	Trans-1,2-DCE (µg/L)	Total-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	Total Chl. VOCs (µg/L)
1381MWD13	3/22/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HPMWD12	3/4/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HPMWD10	3/1/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWD08	3/8/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWD09	3/8/96	ND	ND	ND	ND	ND	65	ND	ND	2.4F	ND	67.4
1381MWD17	5/22/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWD19	5/24/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381MWD04	1/10/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hydropunch Locations - Shallow												
1381HP011	10/30/95	ND	ND	ND	ND	ND	ND	9.1	56	5286	1180	6475.1
1381HP021	10/31/95	ND	ND	ND	ND	ND	870	5.8	26	3386	34	4295.8
1381HP031	10/31/95	ND	ND	ND	ND	ND	370	ND	21	2371	200	2941
1381HP041	11/1/95	ND	ND	ND	ND	ND	1250	ND	8	928	58	2236
1381HP051	11/15/95	ND	ND	ND	ND	ND	ND	ND	ND	81	74	155
1381HP061	11/16/95	ND	ND	ND	ND	ND	15	ND	6	1066	96	1177
1381HP071	11/16/95	ND	ND	ND	ND	ND	ND	ND	ND	5100	560	5660
1381HP091	11/17/95	ND	ND	ND	ND	ND	ND	4.8	9.1	1019.1	720	1743.9
1381HP101	11/17/95	ND	ND	ND	ND	ND	51	6.5	26	3756	210	4023.5
1381HP111	11/17/95	ND	ND	ND	ND	ND	ND	ND	7.4	407.4	160	567.4
1381HP121	11/27/95	ND	ND	ND	ND	ND	ND	6.7	12	1642	1080	2728.7
1381HP081	11/27/95	ND	ND	ND	ND	ND	ND	ND	ND	440	130	570
1381HP141	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP151	12/2/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP161	12/5/95	1	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND
1381HP171	12/5/95	ND	ND	ND	ND	ND	ND	ND	18	128	260	388
1381HP191	12/20/95	ND	ND	ND	ND	ND	ND	ND	ND	63	11	74
1381HP201	12/21/95	ND	ND	ND	ND	ND	ND	ND	8.3	148.3	95	243.3
1381HP181	12/15/95	ND	ND	ND	ND	ND	ND	ND	ND	96	22	118
1381HP131	12/15/95	ND	ND	ND	ND	ND	ND	4.1	21	1021	870	1895.1
1381HP221	1/11/96	ND	ND	ND	ND	ND	ND	2.5	11	681	240	923.5
1381HP231	1/11/96	ND	ND	ND	ND	ND	ND	ND	ND	29	6.2	35.2
1381HP241	1/11/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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TABLE 2.4 (continued)
BTEX AND CHLORINATED VOCs DETECTED IN GROUNDWATER
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Sample Location	Sample Collection	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	TCE (µg/L)	1,1-DCE (µg/L)	Trans-1,2-DCE (µg/L)	Total-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	Total Chl. VOCs (µg/L)
1381HP251	1/19/96	ND	ND	ND	ND	ND	ND	ND	ND	400	97	497
1381HP261	1/19/96	ND	ND	ND	ND	ND	ND	ND	30	1570	1090	2660
1381HP271	1/23/96	ND	ND	ND	ND	ND	ND	ND	ND	18	3	21
1381HP281	1/23/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP291	1/23/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP301	1/24/96	ND	ND	ND	ND	ND	ND	ND	ND	250	33	283
1381HP311	1/24/96	ND	ND	ND	ND	ND	ND	ND	ND	84	100	184
1381HP321	1/25/96	ND	ND	ND	ND	ND	ND	ND	ND	24	4.2	28.2
Hydropunch Locations - Deep												
1381HP012	10/31/95	ND	ND	ND	ND	ND	ND	5.3	11	2211	530	2746.3
1381HP022	10/31/95	ND	ND	ND	ND	ND	120	ND	ND	1010	110	1240
1381HP032	10/31/95	ND	16	8	33	57.0	13267	14	110	6840	290	20411
1381HP042	11/1/95	1.2	12	3.8	18	35.0	10890	8.5	160	2880	87	13865.5
1381HP052	11/15/95	ND	ND	ND	2	2.0	ND	ND	ND	ND	ND	ND
1381HP062	11/16/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	1
1381HP072	11/16/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP102	11/17/95	ND	ND	ND	ND	ND	ND	ND	ND	47	1.8	48.8
1381HP112	11/17/95	ND	ND	ND	ND	ND	ND	ND	ND	86	9.3	95.3
1381HP122	11/27/95	ND	ND	ND	ND	ND	4.7	ND	ND	ND	1	5.7
1381HP082	11/27/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	1.1
1381HP142	12/1/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP152	12/2/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP162	12/5/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP172	12/5/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP09A1	11/17/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP182	12/15/95	ND	ND	ND	ND	ND	ND	ND	ND	42	11	56
1381HP192	12/20/95	ND	ND	ND	ND	ND	ND	ND	ND	17	3.2	20.2
1381HP202	12/21/95	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.7	6.7
1381HP132	12/15/95	ND	ND	ND	ND	ND	ND	2.7	240	4430	2010	6442.7
1381HP222	1/11/96	ND	ND	ND	ND	ND	ND	ND	ND	270	98	368
1381HP232	1/11/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP242	1/11/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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TABLE 2.4 (continued)
BTEX AND CHLORINATED VOCs DETECTED IN GROUNDWATER
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AIR STATION, FLORIDA

Sample Location	Sample Collection	Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Xylenes (µg/L)	Total BTEX (µg/L)	TCE (µg/L)	1,1-DCE (µg/L)	Trans-1,2-DCE (µg/L)	Total-1,2-DCE (µg/L)	Vinyl Chloride (µg/L)	Total Chl. VOCs (µg/L)
1381HP252	1/19/96	ND	ND	ND	ND	ND	ND	ND	ND	130	110	240
1381HP262	1/19/96	ND	ND	ND	ND	ND	ND	ND	ND	140	76	216
1381HP272	1/23/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP282	1/23/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP292	1/23/96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1381HP302	1/24/96	ND	ND	ND	ND	ND	ND	ND	ND	72	18	90
1381HP312	1/24/96	ND	ND	ND	ND	ND	870	8.7	29	4459	570	5907.7
1381HP322	1/25/96	ND	ND	ND	ND	ND	ND	ND	ND	8.4	1.4	9.8

[a] µg/L=micrograms per liter.

[b] The S identifies wells/piezometers which are screened shallow within the surficial aquifer.

[c] ND = analyte not detected

[d] F = estimated value between method detection limit and reporting limit

[e] J = estimated value above reporting limit

[f] NA = data not available

[g] The I identifies wells/piezometers which are screened at an intermediate depth within the surficial aquifer.

[h] The D identifies wells/piezometers which are screened deep within the surficial aquifer.

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shown in Figures 2.9 and 2.10, the greatest extent of chlorinated VOC contamination appears to be near the surface of the shallow aquifer. The maximum total chlorinated VOC concentration in the shallow zone of the surficial aquifer is 38,000 micrograms per liter (µg/L) at monitoring well 1381MWS09.

Chlorinated VOC concentrations in deeper monitoring wells at the site (Figure 2.10) suggest that contamination has penetrated the surficial aquifer to approximately 50 feet bgs. The maximum total chlorinated VOC concentration in the deeper zone of the surficial aquifer is 103.3 µg/L at monitoring well 1381MWD02. Samples collected from only three deep monitoring wells contained chlorinated VOCs (1381MWD02, 1381MWD09, and 1381HPMWD08). However, chlorinated VOCs were detected in 18 deep hydropunch® locations. These hydropunch® locations are suspect because potential drawdown of shallow contaminated groundwater to lower levels may have occurred during hydropunch® sampling. This hypothesis is supported by the observation that many deep monitoring wells had nondetectable concentrations of chlorinated VOCs although they were adjacent to hydropunch® locations with detectable concentrations of chlorinated VOCs [i.e., monitoring well 1381MWD17 versus hydropunch® sample location 1381HP132 (Table 2.4; Figure 2.10)]. Therefore, the area of contamination in the deep portion of the surficial aquifer may be relatively minor.

The presence of the silty/sandy interval at approximately 30 to 35 feet bgs (Figures 2.2 and 2.3) suggests that the potential downward migration of chlorinated VOCs may be inhibited at the silty/sandy interval. It is possible that chlorinated VOCs are sinking to the top of the silty/sandy interval and then preferentially migrating across the top of the interval. Two intermediate wells were installed at the site (1381MWI05 and 1381MWI09) and one contained chlorinated VOC contamination (1381MWI09). Numerous intermediate depth (25 to 30 feet bgs) Geoprobe® monitoring points will be installed to help characterize potential migration of chlorinated VOC contamination above the silty/sandy interval.

Surface water samples collected along the drainage canal approximately 2,500 feet north/northwest of the site and in the path of groundwater migration showed nondetectable concentrations of chlorinated VOCs (Parsons ES, in preparation), suggesting that groundwater discharge to the canal has not adversely impacted surface water quality. However, as illustrated on Figure 2.9, significant concentrations of chlorinated VOCs appear to be discharging to the drainage canal southwest of the site. Total chlorinated VOC concentrations as high as 1,000 µg/L are potentially discharging to the creek southwest of the site. Concentrations of chlorinated VOCs were detected in surface water samples along the discharge length of the creek. These concentrations are summarized in Table 2.5. The highest detected surface water concentration of total chlorinated VOCs was 415 µg/L at 1381SW03, located directly downgradient from the site in an area of suspected highly contaminated groundwater discharge. No chlorinated VOCs were detected in surface waters further than 900 feet down stream from the site.

TABLE 2.5
CHLORINATED VOCs DETECTED IN SURFACE WATER
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Sample Location	Sample Collection	Trans-1,2-DCE (μg/L[a])	Total 1,2-DCE (μg/L)	TCE (μg/L)	Chloroform (μg/L)	Vinyl Chloride (μg/L)
1381SW02	12/17/95	ND[b]	ND	ND	ND	ND
1381SW03	12/17/95	ND	290	87	ND	38
1381SW04	12/17/95	ND	210	71	ND	27
1381DOWN	3/29/96	ND	ND	ND	ND	ND
1381UPGRAD	3/29/96	ND	ND	ND	ND	ND
1381SW05	3/7/96	ND	ND	ND	8.3	ND
1381SW06	3/7/96	ND	ND	ND	7.5	ND
1381SW07	3/7/96	ND	ND	ND	5.1	ND
1381SW08	3/14/96	ND	4.5	ND	ND	6.9J[c]

a/ μg/L = micrograms per liter.

b/ ND = analyte not detected

c/ J = estimated value above reporting limit.

BTEX compounds were detected at six locations (four hydropunch® locations and two monitoring well locations). Concentrations were very low and ranged from 1 µg/L to 57 µg/L total BTEX. The maximum BTEX concentration was detected at hydropunch® location 1381HP031. Trace SVOCs were detected only at monitoring well 1381MWS02 (0.67 and 0.22 µg/L of phenanthrene and fluorene, respectively).

2.1.4 Groundwater Geochemistry

Limited groundwater geochemical data currently are available for the site. Groundwater pH, conductivity, turbidity, and temperature measurements taken between December 1995 and March 1996 are summarized in Appendix A. The pH of groundwater ranged from 6.87 to 8.14, within the range typically encountered at CCAS. Specific conductance (conductivity) readings ranged from 464 to 5550 micromhos per centimeter (µmhos/cm). Elevated conductivity measurements recorded at Facility 1381 are likely due to the saline nature of the water.

Preliminary geochemical results collected at well locations 1381MW01 and 1381MW09 on August 15, 1996, suggest that biodegradation of contaminants is occurring. Dissolved oxygen (DO) concentrations at monitoring well locations 1381MW01 (shallow and deep) and 1381MW09 (shallow, intermediate, and deep) ranged from 0.11 to 1.39 milligrams per liter (mg/L). These results suggest that DO levels are depleted through microbial activity, although background DO concentrations were not obtained for comparison purposes.

2.2 DEVELOPMENT OF CONCEPTUAL MODELS

A conceptual model is a three-dimensional representation of a hydrogeologic system based on available geological, hydrological, climatological, and geochemical data. A site-specific conceptual model is developed to provide an understanding of the mechanisms controlling contaminant fate and transport and to identify additional data requirements. The model describes known and suspected sources of contamination, types of contamination, affected media, and contaminant migration pathways. The model also provides a foundation for formulating decisions regarding additional data collection and potential remedial actions. The conceptual model for Facility 1381 will be used to aid in selecting additional data collection points and to identify appropriate data needs for modeling chlorinated solvent and petroleum hydrocarbon attenuation using groundwater flow and solute transport models.

Successful conceptual model development involves:

- Defining the problem to be solved;
- Integrating available data, including
  - Local geologic and topographic data,
  - Hydraulic data,

- Site stratigraphic data, and

- Contaminant concentration and distribution data;

- Evaluating contaminant fate and transport characteristics;

- Identifying contaminant migration pathways;

- Identifying potential receptors and exposure points; and

- Determining additional data requirements.

2.2.1 RNA and Solute Transport Models

After a site has been adequately characterized, fate and transport analyses can be performed to determine the potential for contaminant migration and human and ecological receptor pathway completion. Groundwater flow and solute transport models have proven useful for predicting plume migration and contaminant attenuation by natural biodegradation. Analytical and numerical models are available for modeling the fate and transport of CAHs under the influence of advection, dispersion, sorption, and natural aerobic and anaerobic biodegradation. Analytical models derived from advection-dispersion equations [e.g., models such as those presented by Wexler (1992) and van Genuchten and Alves (1982)] may be useful. However, because CAH biodegradation may be the result of different processes at different locations in the aquifer, it may be necessary to use a numerical model to incorporate spatial variability in contaminant decay rates.

An accurate estimate of the potential for natural biodegradation of chlorinated compounds in groundwater is important to consider when determining whether groundwater contamination presents a substantial threat to human health or the environment, and when deciding what type of remedial alternative will be most cost effective in eliminating or abating these threats. Over the past two decades, numerous laboratory and field studies have demonstrated that subsurface microorganisms can degrade a variety of hydrocarbons and chlorinated solvents (Lee, 1988; McCarty *et al.*, 1992). The following section discusses the biodegradation of CAHs.

2.2.2 Biodegradation of CAHs

Chlorinated solvents can be transformed, directly or indirectly, by biological processes (e.g., Bouwer *et al.*, 1981; Wilson and Wilson, 1985; Miller and Guengerich, 1982; Nelson *et al.*, 1986; Bouwer and Wright, 1988; Little *et al.*, 1988; Mayer *et al.*, 1988; Arciero *et al.*, 1989; Cline and Delfino, 1989; Freedman and Gossett, 1989; Folsom *et al.*, 1990; Harker and Kim, 1990; Alvarez-Cohen and McCarty, 1991a and 1991b; DeStefano *et al.*, 1991; Henry, 1991; McCarty *et al.*, 1992; Hartmans and de Bont, 1992; McCarty and Semprini, 1994; Vogel, 1994). CAHs may undergo biodegradation through three different pathways: use as an electron acceptor, use as an electron donor, or cometabolism, which is degradation resulting from exposure to a catalytic enzyme fortuitously produced during an unrelated

process. At a given site, one, two, or all of these processes may be operating, although at many sites the use of CAHs as electron acceptors appears to be the most important.

In a pristine aquifer, native organic carbon is utilized as an electron donor and DO is utilized first as the prime electron acceptor. Where anthropogenic carbon (e.g., fuel hydrocarbons or low-molecular-weight CAHs) is present, it also will be utilized as an electron donor. After the DO is consumed, anaerobic microorganisms typically use native electron acceptors (as available) in the following order of preference: nitrate, ferric iron oxyhydroxide, sulfate, and finally carbon dioxide. Evaluation of the distribution of these electron acceptors can provide evidence of where and how CAH biodegradation is occurring. In addition, because CAHs may be used as electron acceptors or electron donors (in competition with other acceptors or donors), isopleth maps showing the distribution of these compounds will also provide evidence on the types of biodegradation processes acting at a site.

As with BTEX, the driving force behind reduction/oxidation (redox) reactions resulting in CAH degradation is electron transfer. Although thermodynamically favorable, most of the reactions involved in CAH reduction and oxidation cannot proceed abiotically because of the lack of activation energy. Microorganisms are capable of providing the necessary activation energy; however, they will facilitate only those redox reactions that have a net yield of energy. A more complete description of the main types of biodegradation reactions affecting CAHs is presented in the following subsections.

2.2.2.1 Electron Acceptor Reactions (Reductive Dehalogenation)

Under anaerobic conditions, biodegradation of chlorinated solvents usually proceeds through a process called reductive dehalogenation, or more specifically, reductive dechlorination. During this process, the halogenated hydrocarbon is used as an electron acceptor, not as a source of carbon, and a halogen atom is removed and replaced with a hydrogen atom. Figure 2.11 illustrates the transformation of chlorinated ethenes via reductive dehalogenation. In general, reductive dehalogenation occurs by sequential dehalogenation from tetrachloroethene (PCE) to TCE to DCE to VC to ethene. Depending upon environmental conditions, this sequence may be interrupted, with other processes then acting upon the products. During reductive dechlorination, all three isomers of DCE can theoretically be produced; however, Bouwer (1994) reports that under the influence of biodegradation, *cis*-1,2-DCE is a more common intermediate than *trans*-1,2-DCE, and that 1,1-DCE is the least prevalent intermediate of the three DCE isomers. Reductive dehalogenation of chlorinated organic compounds is associated with the accumulation of daughter products and an increase in chloride.

Reductive dehalogenation affects each of the chlorinated ethenes differently. Of these compounds, PCE is the most susceptible to reductive dehalogenation because it is the most oxidized. Conversely, VC is the least susceptible to reductive dehalogenation because it is the least oxidized of these compounds. The rate of reductive

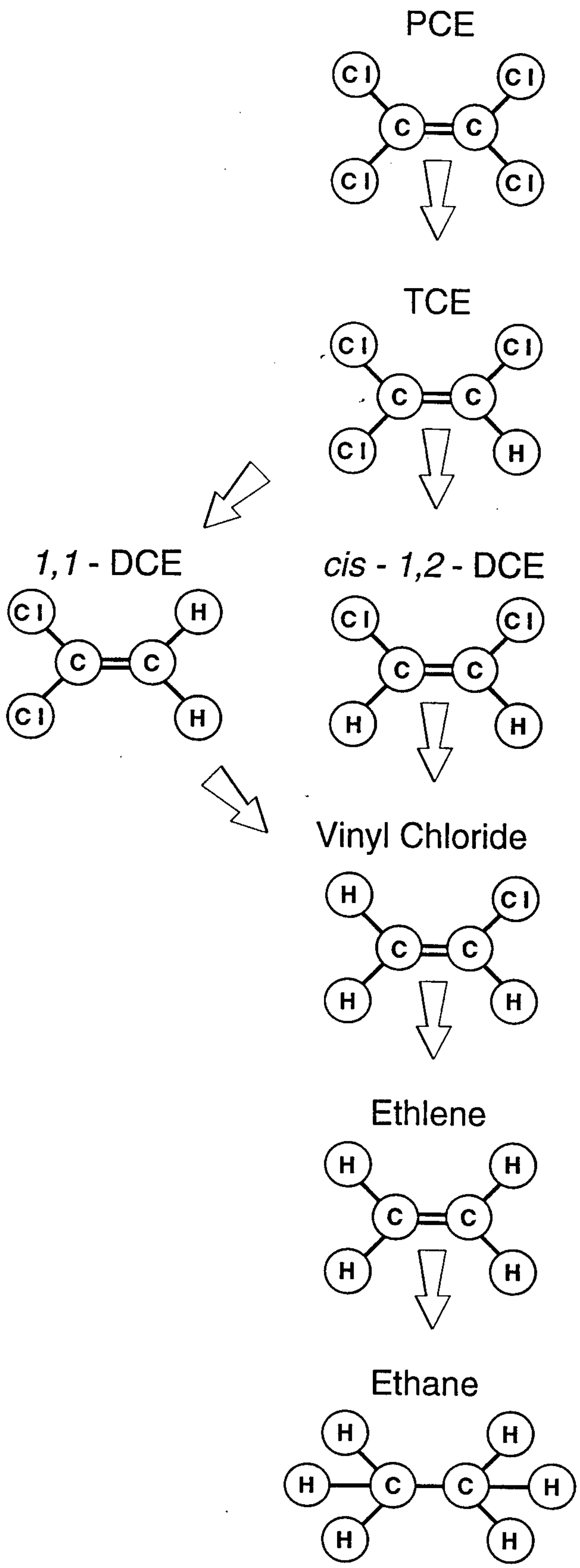

FIGURE 2.11

ANAEROBIC REDUCTIVE DEHALOGENATION

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dehalogenation also has been observed to decrease as the degree of chlorination decreases (Vogel and McCarty, 1985; Bouwer, 1994). Murray and Richardson (1993) have postulated that this rate decrease may explain the accumulation of VC in PCE and TCE plumes that are undergoing reductive dehalogenation. Reductive dehalogenation has been demonstrated under anaerobic nitrate- and sulfate-reducing conditions, but the most rapid biodegradation rates, affecting the widest range of CAHs, occur under methanogenic conditions (Bouwer, 1994).

Because CAH compounds are used as electron acceptors, there must be an appropriate source of carbon for microbial growth in order for reductive dehalogenation to occur (Bouwer, 1994). Potential carbon sources can include low-molecular-weight compounds (e.g., lactate, acetate, methanol, or glucose) present in natural organic matter, or fuel hydrocarbons.

2.2.2.2 Electron Donor Reactions

Under aerobic conditions some CAH compounds can be utilized as the primary substrate (i.e., electron donor) in biologically mediated redox reactions (McCarty and Semprini, 1994). In this type of reaction, the facilitating microorganism obtains energy and organic carbon from the degraded CAH. In contrast to reactions in which the CAH is used as an electron acceptor, only the least oxidized CAHs can be utilized as electron donors in biologically mediated redox reactions. McCarty and Semprini (1994) describe investigations in which VC and 1,2-DCA were shown to serve as primary substrates. These authors also document that dichloromethane has the potential to function as a primary substrate under either aerobic or anaerobic environments. In addition, Bradley and Chapelle (1996) show evidence of mineralization of VC under iron-reducing conditions so long as there is sufficient bioavailable iron (III). Murray and Richardson (1993) report that microorganisms are generally believed to be incapable of growth using TCE and PCE. Aerobic metabolism of VC may be characterized by a loss of VC mass, a decreasing molar ratio of VC to other CAH compounds, and the presence of chloromethane.

2.2.2.3 Cometabolism

When a CAH is biodegraded through cometabolism, it serves as neither an electron acceptor nor a primary substrate in a biologically mediated redox reaction. Instead, the degradation of the CAH is catalyzed by an enzyme or cofactor that is fortuitously produced by organisms for other purposes. The organism receives no known benefit from the degradation of the CAH; rather the cometabolic degradation of the CAH may in fact be harmful to the microorganism responsible for the production of the enzyme or cofactor (McCarty and Semprini, 1994).

Cometabolism is best documented in aerobic environments, although it potentially could occur under anaerobic conditions. Aerobic biodegradation pathways for chlorinated ethenes are illustrated in Figure 2.12. It has been reported that under aerobic conditions chlorinated ethenes, with the exception of PCE, are susceptible to cometabolic degradation (Murray and Richardson, 1993; Vogel, 1994; McCarty and

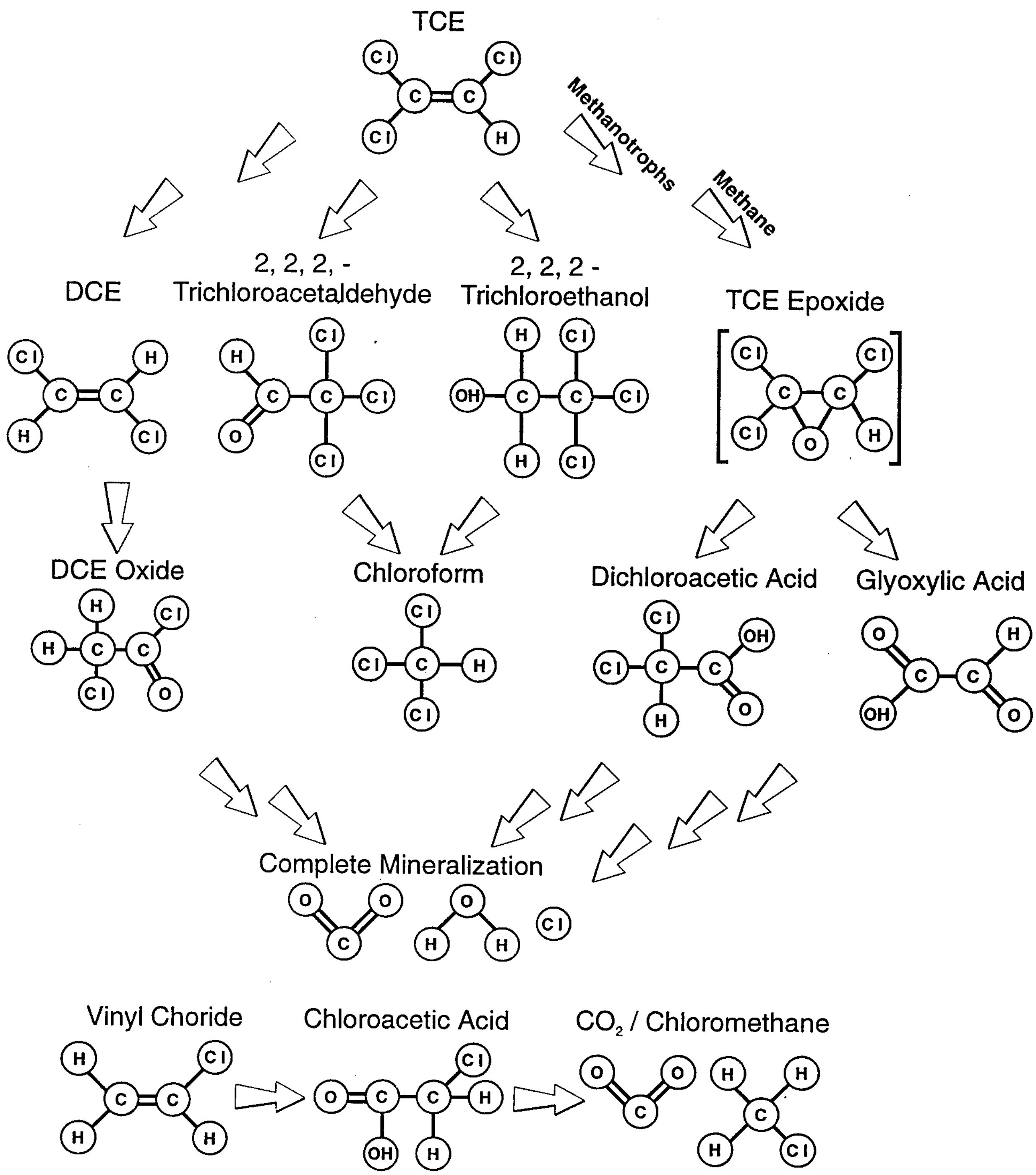

FIGURE 2.12

AEROBIC DEHALOGENATION

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Semprini, 1994). Vogel (1994) further elaborates that the cometabolism rate increases as the degree of dehalogenation decreases.

In the cometabolic process, TCE is indirectly transformed by bacteria as they use BTEX or another substrate to meet their energy requirements. Therefore, TCE does not enhance the degradation of BTEX or other carbon sources, nor will its cometabolism interfere with the use of electron acceptors involved in the oxidation of those carbon sources. It is likely that depletion of suitable substrates (BTEX or other organic carbon sources) may limit cometabolism of CAHs.

2.2.2.4 Behavior of Chlorinated Solvent Plumes

Chlorinated solvent plumes can exhibit three types of behavior depending on the amount of solvent, the amount of organic (native and/or anthropogenic) carbon in the aquifer, the distribution and concentration of natural electron acceptors, and the types of electron acceptors being utilized. Individual plumes may exhibit all three types of behavior in different portions of the plume. The different types of plume behavior are summarized below.

2.2.2.4.1 Type 1 Behavior

Type 1 behavior occurs where the primary substrate is anthropogenic carbon (e.g., BTEX or landfill leachate), and this anthropogenic carbon drives reductive dehalogenation. When evaluating intrinsic remediation of a plume exhibiting type 1 behavior the following questions must be answered:

1) Does electron acceptor supply exceed demand (i.e., is the electron acceptor supply adequate)?

2) Will the CAH plume "strangle" before it "starves" [i.e., will it run out of CAHs (electron acceptors) before it runs out of primary substrate (anthropogenic carbon)]?

3) What is the role of competing electron acceptors?

4) Is VC oxidized, or is it reduced?

2.2.2.4.2 Type 2 Behavior

Type 2 behavior dominates in areas that are characterized by relatively high native organic carbon concentrations, and this carbon source drives reductive dehalogenation (i.e., the primary substrate for microorganism growth is native organic carbon). When evaluating intrinsic remediation of a type 2 chlorinated solvent plume, the same questions as those posed in the description of type 1 behavior must be answered.

2.2.2.4.3 Type 3 Behavior

Type 3 behavior dominates in areas that are characterized by low native and/or anthropogenic carbon concentrations, and DO concentrations that are greater than 1.0 mg/L. Under these conditions the plume is aerobic, and reductive dehalogenation will not occur. Thus there is no reductive dehalogenation of PCE, TCE, and DCE. Biodegradation may proceed via the much slower process of cometabolism, but will be limited by the low concentrations of native or anthropogenic carbon. The most significant natural attenuation mechanisms for these compounds will be advection, dispersion, and sorption. However, VC could be oxidized under these conditions.

2.2.2.4.4 Mixed Behavior

As mentioned above, a single chlorinated solvent plume can exhibit all three types of behavior in different portions of the plume. This can be beneficial for natural biodegradation of CAH plumes. For example, Wiedemeier *et al.* (1996) describe a plume at Plattsburgh AFB, New York that exhibits type 1 behavior in the source area and type 3 behavior downgradient from the source. The best scenario involves a plume in which TCE and DCE are reductively dehalogenated (type 1 or 2 behavior), then VC is oxidized (type 3 behavior), either aerobically or anaerobically (via iron reduction). VC is oxidized to carbon dioxide in this type of plume and does not accumulate. The following sequence of reactions occurs in this type of plume.

$$TCE \rightarrow DCE \rightarrow VC \rightarrow CO_2$$

In general, the TCE, DCE, and VC may attenuate at approximately the same rate, and thus these reactions may be confused with simple dilution. Note that no ethene is produced during this reaction. VC is removed from the system much faster under these conditions than it is under VC-reducing conditions.

A less desirable scenario involves a plume in which all CAHs are reductively dehalogenated (type 2 or 3 behavior). VC is reduced to ethene, which is further reduced to ethane. The following sequence of reactions occur in this type of plume.

$$TCE \rightarrow DCE \rightarrow VC \rightarrow Ethene \rightarrow Ethane$$

In this type of plume, DCE and VC degrade more slowly than TCE, and thus they tend to accumulate. This type of reductive dehalogenation is the described by Freedman and Gossett (1989).

2.2.3 Initial Conceptual Model

Cross-sections A-A' and B-B' (Figures 2.2 and 2.3) show that the site hydrogeology is relatively simple, with sands becoming more silty at depth (approximately 35 feet bgs) and ending at a clay unit (approximately 50 feet bgs). Figures 2.6 and 2.7 are groundwater elevation and potentiometric surface maps prepared using June 1996 groundwater elevation data for shallow and deep monitoring wells, respectively. Depth

to groundwater is relatively uniform at approximately 5 feet bgs. Groundwater flow is dictated by drainage canals to the north/northwest and to the southwest and by a groundwater divide to the north of Facility 1381, near the weather station. This groundwater divide causes groundwater to the south of the divide to flow to the south/southwest and groundwater to the north of the divide to flow to the north. Groundwater in the landfill area south of Facility 1381 flows to the northeast and toward the adjacent drainage canal (Figure 2.6). The deep confined aquifer appears to be isolated from the shallow aquifer by a clay confining unit approximately 9 feet thick. On the basis of the available data, Parsons ES will model the site as an unconfined, sandy to silty sand aquifer. This conceptual model will be modified as necessary as additional site hydrogeologic data become available.

CAHs, the chemicals of concern in groundwater at Facility 1381, will be the primary focus of this RNA demonstration because of their regulatory importance. Available site data do not clearly identify a source area for CAHs (drums were previously stored outside of the fenced area at Facility 1381, near monitoring well 1381MW09). No free-phase product has been detected at the site, and the potential for continued contributions to groundwater contamination is unknown. CAHs discharged to surface water (the drainage canal to the southwest) appear to volatilize to non-detectable concentrations within 900 feet downgradient of the suspected discharge zone.

In addition to the effects of mass transport mechanisms (volatilization, dispersion, diffusion, and adsorption), the dissolved CAH contaminants likely will be removed from the groundwater system by naturally occurring destructive attenuation mechanisms, such as biodegradation. Given available information, the CAH plume originating at Facility 1381 appears to exhibit type 2 behavior, with native organic carbon utilized in the biodegradation reactions. High DCE concentrations, specifically in the source area, suggest that TCE is being reductively dehalogenated to DCE. The relatively high concentrations of DCE suggest that TCE may not be limited by the availability of a substrate or an electron donor (e.g., native organic carbon). In particular, the distribution of *cis*-1,2-DCE is most useful, because this isomer is preferentially produced through biodegradation of TCE (Bouwer, 1994). The majority of 1,2-DCE produced through biodegradation appears to be *cis*-1,2-DCE, as indicated in Table 2.4 (difference between total-1,2-DCE and *trans*-1,2-DCE). Concentrations of *cis*-1,2-DCE are present wherever TCE is detected, but in lower concentrations. In addition, the area of the highest *cis*-1,2-DCE concentration is slightly downgradient (1381MWS01) from the area of the highest TCE concentration (1381MWS09), on the basis of apparent groundwater plume migration. This is a preliminary indication that TCE is being biodegraded to DCE. Furthermore, vinyl chloride (VC), another daughter product of TCE biodegradation, is common throughout the site.

It is not likely that in the past the CAH plume may have exhibited type 1 behavior because of minimal use of petroleum hydrocarbons at the site, except as co-solvenated residual hydrocarbons derived during metal cleaning operations. It is also possible that some portions of the plume exhibit type 3 behavior, depending upon the concentrations and availability of natural organic carbon, DO, and nitrate. This will be further clarified with the results of the sampling to be conducted for this RNA demonstration.

The effects of fate and transport processes on the dissolved CAH groundwater plume will be investigated using quantitative groundwater analytical data and solute-transport models. Data collection and analytical requirements are discussed in Section 3 of this work plan.

SECTION 3

COLLECTION OF ADDITIONAL DATA

To complete the demonstration and to document that RNA of chlorinated solvents is occurring at Facility 1381, additional site-specific physical and chemical hydrogeologic data will be collected to supplement the available site data. Sampling locations are presented on Figure 3.1. Many of these measurements and analyses are commonly performed at hazardous waste sites; however, some of the data will be collected specifically to assess the potential for use of RNA for the CAH plume originating from Facility 1381.

Physical hydrogeologic characteristics to be determined include:

- Depth from measurement datum to the groundwater surface in site monitoring wells;
- Locations of potential groundwater recharge and discharge areas;
- Locations of downgradient wells and their uses;
- Hydraulic conductivity through slug tests, as required;
- Estimates of dispersivity, where possible;
- Stratigraphic analysis of subsurface media; and
- Groundwater temperature.

Chemical hydrogeologic characteristics to be determined include:

- DO concentrations;
- Specific conductance;
- pH;
- Oxidation/reduction potential (ORP);
- Total organic carbon (TOC); and

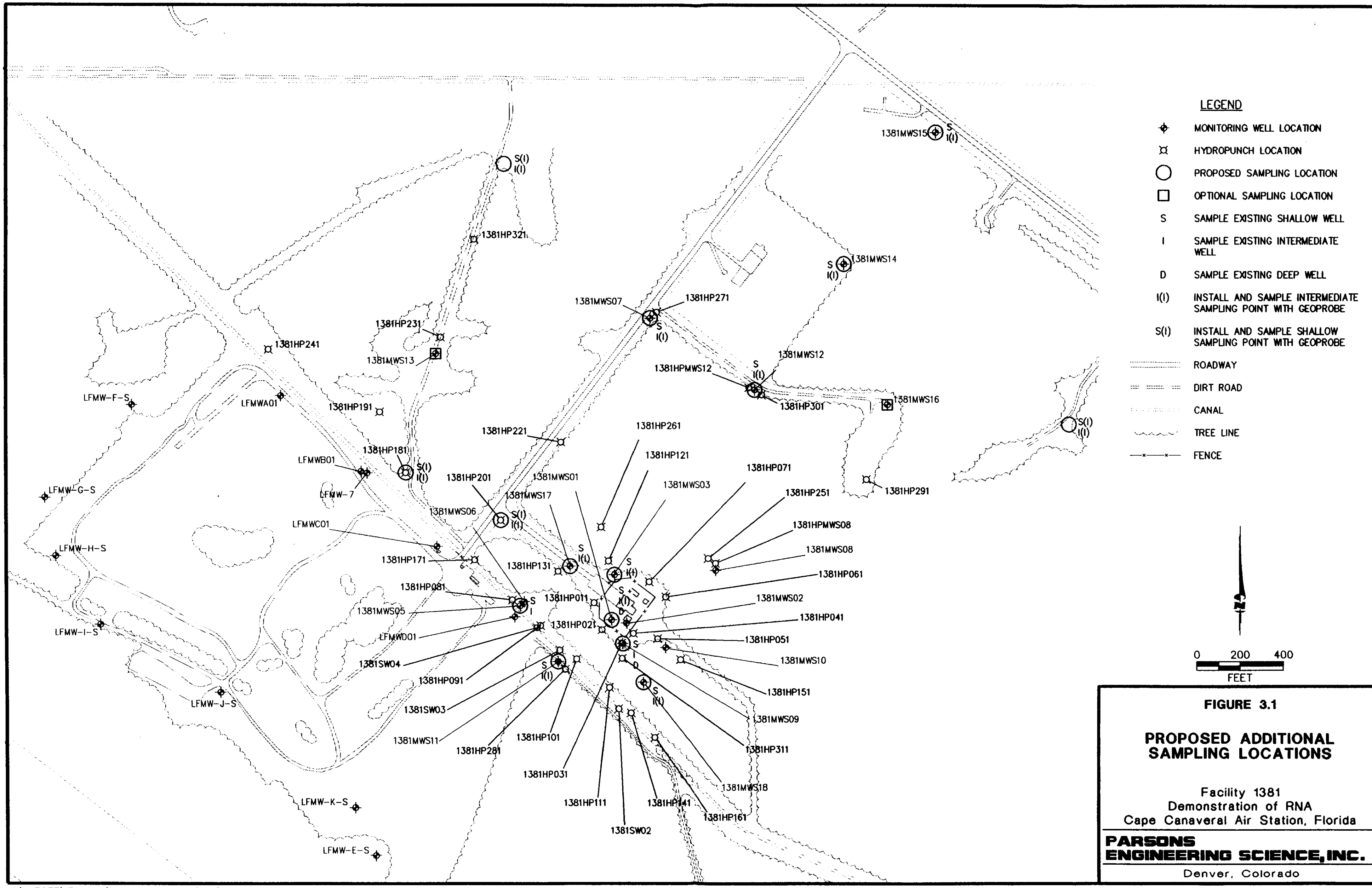

FIGURE 3.1

PROPOSED ADDITIONAL SAMPLING LOCATIONS

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- Additional chemical analysis of groundwater samples, surface water samples, and soil and sediment samples for the parameters listed in Table 3.1.

Physical hydrogeologic parameters will be measured to further refine the site conceptual model and to aid in assembling and calibrating the groundwater flow portion of a site-specific solute transport model.

In general, analyses will be made to allow an inference of which biodegradation processes are ongoing, as well as to provide information useful for transport modeling. Some inorganic groundwater chemical parameters [e.g., iron (II), DO, and sulfate] are measured to evaluate if there is any ongoing degradation of native (or anthropogenic) carbon, as discussed in Section 2.2.2. If such processes are ongoing, they may facilitate degradation of CAHs via the pathways discussed in Section 2.2.2. Chloride data can be used as an indicator of reductive dehalogenation, which would increase chloride concentrations in the plume interior. ORP will be measured to help evaluate whether conditions are sufficiently reducing for reductive dehalogenation, and for use as an indicator parameter during well purging (along with DO, temperature, pH, and conductivity). Methane, ethane, and ethene will be measured for evidence of complete dehalogenation of CAHs, while VOC concentrations also can be used to further evaluate the ongoing processes, as discussed in Section 2.2.2.

Soil analyses will largely be performed to gain information of the distribution and concentrations of organic carbon, which can affect sorption or act as an electron donor. Additional analyses not listed in Table 3.1 may be performed at the discretion of the USEPA NRMRL scientists working at this site. Additional analytes that may be tested for are listed in Appendix B.

To obtain these data, soil and groundwater samples will be collected and analyzed. The following sections describe the procedures that will be followed when collecting additional site-specific data. Procedures to be used to collect soil core samples are described in Section 3.1. Procedures to be used for the installation of new monitoring points are described in Section 3.2. Procedures to be used to sample groundwater monitoring wells and newly installed groundwater monitoring points are described in Section 3.3. Sample handling procedures are described in Section 3.4, and procedures used to measure aquifer parameters (e.g., hydraulic conductivity) are described in Section 3.5.

3.1 SOIL SAMPLING AND ANALYSIS

The following sections describe soil sampling locations, sample collection techniques, equipment decontamination procedures, site restoration, and management of investigation-derived waste materials.

3.1.1 Soil Sampling Locations and Analyses

Soil samples will be collected at up to four locations at Facility 1381. Most soil samples will be collected at monitoring point installation locations upgradient and

TABLE 3.1
ANALYTICAL PROTOCOL FOR GROUNDWATER, SURFACE WATER, SOIL, AND SEDIMENT SAMPLES
FACILITY 1381
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MATRIX Analyte	METHOD	FIELD (F) OR FIXED-BASE LABORATORY (L)
GROUNDWATER		
Total Iron	Colorimetric, Hach Method 8008	F
Ferrous Iron (Fe^{2+})	Colorimetric, Hach Method 8146	F
Ferric Iron (Fe^{3+})	Difference between total and ferrous iron	F
Manganese	Colorimetric, Hach Method 8034	F
Sulfate	Colorimetric, Hach Method 8051	F
Nitrate	Titrimetric, Hach Method 8039	F
Nitrite	Titrimetric, Hach Method 8507	F
ORP	A2580B, direct-reading meter	F
Oxygen	Direct-reading meter	F
pH	USEPA method E150.1/SW9040, direct-reading meter	F
Conductivity	USEPA method E120.1/SW9050, direct-reading meter	F
Temperature	USEPA method E170.1, direct-reading meter	F
Carbon Dioxide	Titrimetric, Hach Method 1436-01	F
Alkalinity (Carbonate [CO_3^{2-}]	F = Titrimetric, Hach Method 8221	F
and Bicarbonate [HCO_3^-])	L = USEPA Method 310.1	L
Nitrate + Nitrite	USEPA Method 353.1	L
Chloride	Waters Capillary Electrophoresis Method N-601	L
Sulfate	Waters Capillary Electrophoresis Method N-601	L
Methane, Ethane, Ethene	RSKSOP-147[a/]	L
Dissolved Organic Carbon	RSKSOP-102	L
VOCs (BTEX, CAHs, chloroform, chloromethane)	RSKSOP-148	L
SURFACE WATER		
VOCs (BTEX + CAHs)	RSKSOP-148	L
SOIL		
Total Organic Carbon	RSKSOP-102 & RSKSOP-120	L
Moisture	ASTM D-2216	L
VOCs (BTEX + CAHs)	RSKSOP-124, modified	L
SEDIMENT		
VOCs (BTEX + CAHs)	RSKSOP-124, modified	L

[a/] RSKSOP = Robert S. Kerr Laboratory (now NRMRL) Standard Operating Procedure.

NOTE: Additional analyses (as indicated in Appendix B) also may be performed at the discretion of Parsons ES and USEPA NRMRL personnel.

downgradient from the CAH plume for analysis of saturated soil TOC content. These locations will be selected in the field. Table 3.1 presents an analytical protocol for soil samples, and Appendix B contains detailed information on the analyses and methods to be used during this sampling effort. Because of the soil analytical data documented during previous site characterization efforts, soil sampling requirements will be minimal. Soil samples to be analyzed for BTEX and chlorinated VOCs only will be collected if a suspected source area of free product is discovered at the site.

Where soil samples are collected, a minimum of two samples will be collected from each location. One sample will be taken at the water table, and one will be taken beneath the water table. Given the amount of previous soil data, the main purpose of soil sampling for this work will be to determine aquifer matrix TOC concentrations. Additional samples and sampling intervals may be selected at the discretion of the Parsons ES scientist.

A portion of each sample will be used to measure soil headspace, while another portion of selected samples will be sent to NRMRL onsite mobile laboratory for analysis. Each laboratory soil sample will be placed in an analyte-appropriate sample container and hand-delivered to the USEPA field laboratory personnel for analysis. If possible, at least two saturated soil samples from locations upgradient, crossgradient, or far downgradient from the contaminant source will be analyzed for TOC. Each headspace screening sample will be placed in a sealed plastic bag or mason jar and allowed to sit for at least 5 minutes. Soil headspace will then be determined using an organic vapor meter (OVM), and the results will be recorded in the field records by the Parsons ES field scientist.

3.1.2 Sample Collection Using the Geoprobe® System

Soil samples will be collected using a Geoprobe® system, which is a hydraulically powered percussion/probing machine capable of advancing sampling tools through unconsolidated soils. This system allows rapid collection of soil, soil gas, or groundwater samples at shallow depths while minimizing the generation of investigation-derived waste materials. Figure 3.2 is a diagram of the Geoprobe® system.

Soil samples will be collected using a probe-drive sampler. The probe-drive sampler serves as both the driving point and the sample collection device and is attached to the leading end of the probe rods. To collect a soil sample, the sampler is pushed or driven to the desired sampling depth, the drive point is retracted to open the sampling barrel, and the sampler is subsequently pushed into the undisturbed soils. The soil cores are retained within brass, stainless steel, or clear acetate liners inside the sampling barrel. The probe rods are then retracted, bringing the sampling device to the surface. The soil sample can then be extruded from the liners for lithologic logging, or the liners can be cut to the desired length, capped, and submitted to the analytical laboratory for testing of the undisturbed samples.

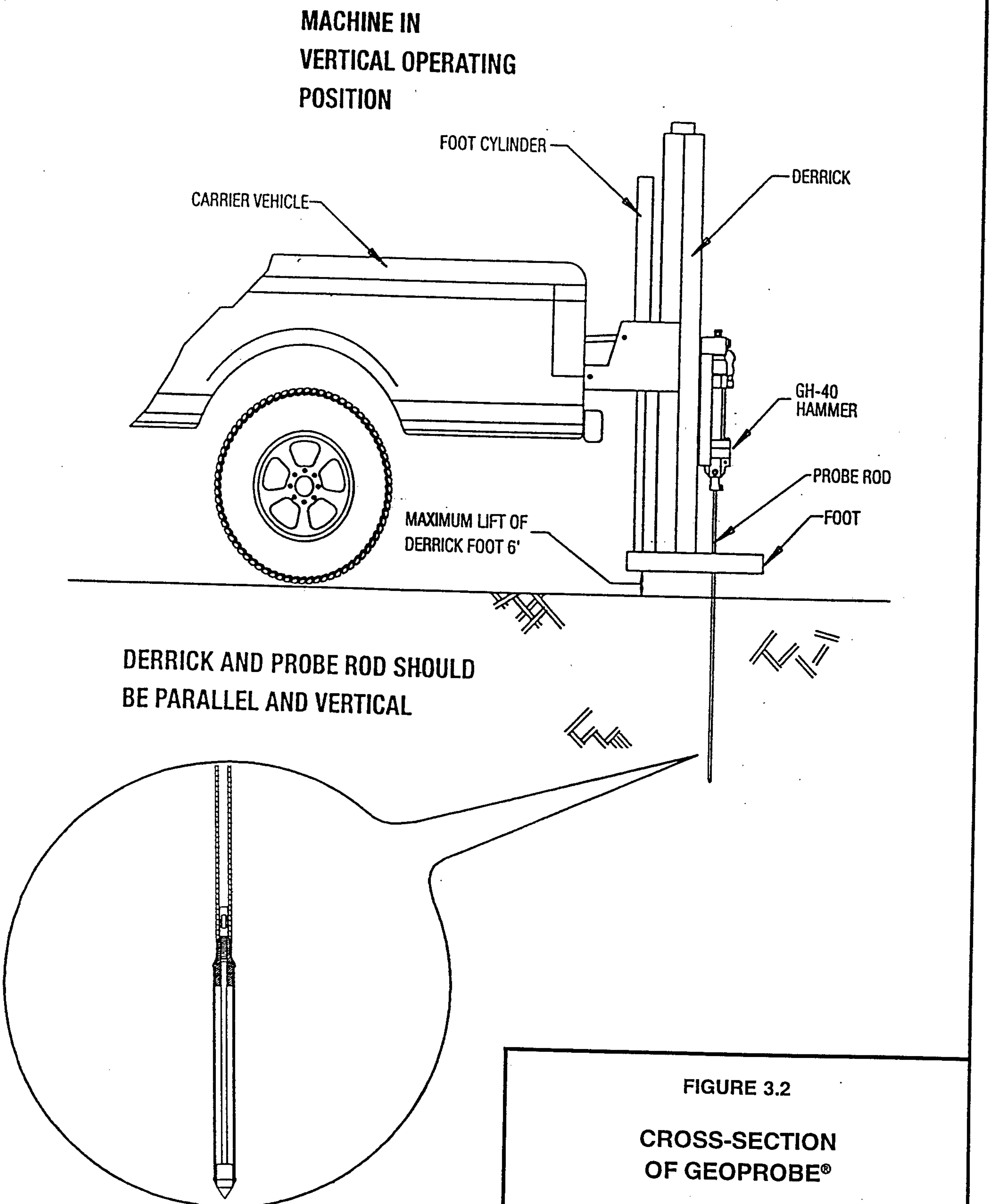

FIGURE 3.2

CROSS-SECTION
OF GEOPROBE®

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If the probe-drive sampling technique described above is inappropriate, inadequate, or unable to efficiently provide sufficient soil samples for the characterization of the site, continuous soil samples will be obtained from conventional sore boreholes using a hand auger or similar method judged acceptable by the Parsons ES field scientist. Procedures will be modified, if necessary, to ensure good sample recovery.

The Parsons ES field scientist will be responsible for observing all field investigation activities, maintaining a detailed descriptive log of all subsurface materials recovered during soil coring, photographing representative samples, and properly labeling and storing samples. An example geologic boring log form is presented as Figure 3.3. The descriptive log will contain:

- Sample interval (top and bottom depth);
- Sample recovery;
- Presence or absence of contamination (as indicated by OVM readings);
- Lithologic description, including relative density, color, major textural constituents, minor constituents, porosity, relative moisture content, plasticity of fines, cohesiveness, grain size, structure or stratification, relative permeability, and any other significant observations; and
- Depths of lithologic contacts and/or significant textural changes measured and recorded to the nearest 0.1 foot.

CCAS personnel will be responsible for identifying the location of all utility lines, fuel lines, or any other underground infrastructure prior to any sampling activities. All necessary digging permits will be obtained through AS personnel prior to mobilizing to the field. Parsons ES (Orlando) personnel currently working at the site and familiar with site infrastructure may aid in obtaining necessary permits. If necessary, AS personnel also will be responsible for acquiring drilling and monitoring point installation permits for the proposed locations. Parsons ES and the USEPA NRMRL will provide trained operators for the Geoprobe®.

3.1.3 Datum Survey

The horizontal location of all soil sampling locations relative to established site coordinates will be measured by a surveyor. Horizontal coordinates will be measured to the nearest 0.1 foot. The elevation of the ground surface will also be measured to the nearest 0.1 foot relative to US Geological Survey (USGS) msl data.

3.1.4 Site Restoration

After sampling is complete, each sampling location will be restored as closely to its original condition as possible. Holes created by the Geoprobe® in sandy soils similar to those found at CCAS tend to cave in soon after extraction of the drive sampler. However, any test holes remaining open after extraction of the push rod will be sealed

GEOLOGIC BORING LOG

BORING NO.: ____________ CONTRACTOR: ____________ DATE SPUD: ____________
CLIENT: AFCEE RIG TYPE: ____________ DATE CMPL.: ____________
JOB NO.: 729691 DRLG METHOD: ____________ ELEVATION: ____________
LOCATION: FACILITY 1381 BORING DIA.: ____________ TEMP: ____________
GEOLOGIST: ____________ DRLG FLUID: ____________ WEATHER: ____________
COMENTS: ____________

Elev (ft)	Depth (ft)	Pro-file	US CS	Geologic Description	Sample No.	Sample Depth (ft)	Sample Type	Penet Res	PID(ppm)	TLV(ppm)	TOTAL BTEX(ppm)	TPH (ppm)
	1											
	5											
	10											
	15											
	20											
	25											
	30											
	35											

NOTES
bgs – Below Ground Surface
GS – Ground Surface
TOC – Top of Casing
NS – Not Sampled
SAA – Same As Above

SAMPLE TYPE
D – DRIVE
C – CORE
G – GRAB

Water level drilled

FIGURE 3.3

GEOLOGIC BORING LOG

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with bentonite chips, pellets, or grout to eliminate any creation or enhancement of contaminant migration pathways to the groundwater. Soil sampling using the Geoprobe® creates low volumes of soil waste. Soil not used for sampling will be placed in 55-gallon drums to await proper disposal by Parsons ES personnel. Alternate methods of soil waste disposal will be considered by the Parsons ES field scientist as recommended by Base personnel.

3.1.5 Equipment Decontamination Procedures

Prior to arriving at the site, and between each sampling location, probe rods, tips, sleeves, pushrods, samplers, tools, and other downhole equipment will be decontaminated using a high-pressure, steam/hot water wash. Only potable water will be used for decontamination.

Between each soil sample, the sampling barrel will be disassembled and decontaminated with Alconox® and potable water. The barrel will then be rinsed with deionized water and reassembled with new liners. Between uses, the sampling barrel will be wrapped in clean plastic or foil to prevent contamination.

All rinseate will be collected for transportation and proper disposal by CCAS personnel. Alternate methods of rinseate disposal will be considered by the Parsons ES field scientist as recommended by AS personnel.

Potable water to be used during equipment cleaning, decontamination, or grouting will be obtained from one of the Base potable water supplies. Water use approval will be verified by contacting the appropriate facility personnel. The field scientist will make the final determination as to the suitability of site water for these activities. Precautions will be taken to minimize any impact to the surrounding area that might result from decontamination operations.

3.2 MONITORING POINT INSTALLATION

To further characterize site hydrogeologic conditions, 17 additional groundwater monitoring points will be installed at shallow depths and intermediate depths at locations within and adjacent to Facility 1381. Shallow monitoring points (5 to 10 feet bgs) will be installed at 3 locations. Intermediate-depth (25 to 30 feet bgs) monitoring points will be installed at all 12 locations. The following sections describe the proposed monitoring point locations and completion intervals, and monitoring point installation, monitoring point development, and equipment decontamination procedures. If site conditions prevent installation of monitoring points, groundwater grab samples will be collected using the Geoprobe® apparatus.

3.2.1 Monitoring Point Locations and Completion Intervals

The locations of the proposed groundwater sampling locations are identified on Figure 3.1. The proposed locations for the new monitoring points were determined based on a review of data gathered during previous site activities. Monitoring point

locations were selected to provide hydrogeologic data necessary for successful implementation of a site-specific contaminant fate and transport model and to monitor potential chlorinated solvent migration from the site, including data on natural attenuation processes in the CAH plume. The 17 proposed locations shown on Figure 3.1 may be modified in the field as a result of encountered field conditions and acquired field data. The points will be placed with the intent of verifying the downgradient plume extent and for collecting additional data from within and upgradient from the plume.

Most monitoring points installed for this evaluation will be installed at intermediate depths (25 to 30 feet bgs) in the shallow aquifer. These points will be installed to monitor the potential migration of CAHs through the mostly uncharacterized intermediate zone of the shallow aquifer. Available hydrogeologic information (Figures 2.6 and 2.7) suggest that preferential contaminant migration may occur across the top of the silty sand zone located approximately 30 to 35 feet bgs. The soil matrix above this silty sand layer is comprised of highly conductive fine- to coarse-grained sands. Nine proposed intermediate depth screened interval monitoring points will be placed adjacent to an existing well. Eight proposed monitoring points, which will consist of a shallow and an intermediate depth screened interval monitoring point will not be installed adjacent to an existing monitoring well. Shallow monitoring points will be screened near the water table surface, or approximately 5 to 10 feet bgs. Intermediate depth monitoring points will be screened approximately 25 to 30 feet bgs. All shallow monitoring points will have a screened interval of 3 feet, while deeper points will have 6-inch screens. The proposed screened intervals will help mitigate the dilution of water samples from potential vertical mixing of contaminated and uncontaminated groundwater in the monitoring point casing. Adjustments of the depth and length of the screened interval of the monitoring points may be necessary in response to actual aquifer conditions and contaminant distribution identified during Geoprobe® testing.

3.2.2 Monitoring Point Installation Procedures

3.2.2.1 Pre-Placement Activities

All necessary digging, coring, and drilling permits will be obtained prior to mobilizing to the field. In addition, all utility lines will be located, and proposed drilling locations will be cleared prior to any intrusive activities.

Water to be used in monitoring point installation and equipment cleaning will be obtained from one of the CCAS potable water supplies. Water use approval will be verified by contacting the appropriate facility personnel. The field scientist will make the final determination as to the suitability of site water for these activities.

3.2.2.2 Monitoring Point Materials Decontamination

Monitoring point installation and completion materials will be inspected by the field scientist and determined to be clean and acceptable prior to use. If not factory sealed,

the well points, casing, and tubing will be cleaned prior to use with a high-pressure, steam/hot-water cleaner using approved water. Materials that cannot be cleaned to the satisfaction of the field scientist will not be used.

3.2.2.3 Installation and Materials

This section describes the procedures to be used for installation of monitoring points. Monitoring points will be installed using either 0.375-inch Teflon® tubing connected to a 0.5-inch-diameter stainless steel screen or a 0.5-inch inside-diameter (ID)/0.75-inch outside-diameter (OD) polyvinyl chloride (PVC) screen and casing.

3.2.2.3.1 Intermediate Monitoring Points

The intermediate monitoring points will be installed in boreholes punched using the Geoprobe®. Each intermediate-depth monitoring point will be constructed of a sacrificial drive point attached to a length of 0.5-inch-diameter stainless steel mesh that will function as the well screen, which in turn will be connected to 0.375-inch Teflon® tubing.

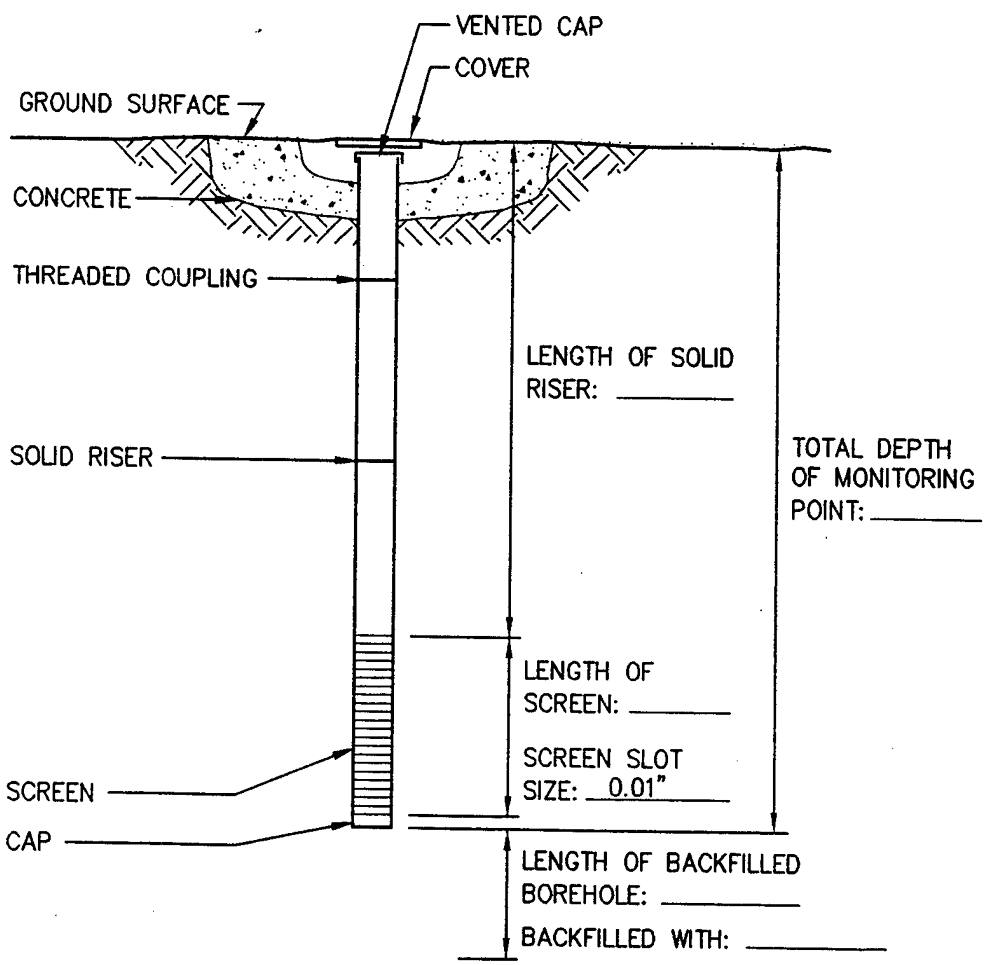
To install the intermediate monitoring points, the borehole is punched and sampled to several feet above the target depth for the monitoring point. The probe rods are withdrawn from the borehole, and the soil sampler is replaced with the well point assembly. An appropriate length of Teflon® tubing is threaded through the probe rods and attached to the well point. The assembly is lowered into the borehole and then driven down to the target depth and sampling zone. The probe rods are removed, leaving the sacrificial tip, screen assembly, and tubing behind. The soil is likely to cave in around the screen and tube assembly; where this does not occur, silica sand will be emplaced to create a sand pack around the well point, and the borehole annular space around the tubing above the sand pack will be filled with granular bentonite or grout to seal it. Monitoring point construction details will be noted on a Monitoring Point Installation Record form (Figure 3.4).

3.2.2.3.2 Shallow Monitoring Points

If subsurface conditions permit, shallow monitoring points will be constructed of 0.75-inch-OD/0.5-inch-ID PVC casing and well screen to provide additional water level information. Approximately 3 feet of factory-slotted screen will be installed for each shallow monitoring point. Shallow 0.5-inch-ID PVC monitoring points will be installed by punching and sampling a borehole with the Geoprobe®. Effective installation of the shallow monitoring points requires that the boreholes remain open temporarily after the borehole is punched and the rods are withdrawn. Upon removing the rods, the borehole depth will be measured to determine if the hole remains open. If the borehole is open, the 0.5-inch-ID PVC casing and screen will be placed at the appropriate depths. The annular space around the screen will be filled with sand filter pack, and the annulus around the casing will be filled with grout or bentonite. Monitoring point construction details will be noted on a Monitoring Point Installation

MONITORING POINT INSTALLATION RECORD

JOB NAME FACILITY 1381 MONITORING POINT NUMBER ______
JOB NUMBER 729691 INSTALLATION DATE ______ LOCATION ______
DATUM ELEVATION ______ GROUND SURFACE ELEVATION ______
DATUM FOR WATER LEVEL MEASUREMENT ______
SCREEN DIAMETER & MATERIAL ______ SLOT SIZE ______
RISER DIAMETER & MATERIAL ______ BOREHOLE DIAMETER ______
CONE PENETROMETER CONTRACTOR ______ ES REPRESENTATIVE ______



(NOT TO SCALE)

STABILIZED WATER LEVEL ______ FEET BELOW DATUM.

TOTAL MONITORING POINT DEPTH ______ FEET BELOW DATUM.

GROUND SURFACE ______ FEET

FIGURE 3.4

MONITORING POINT INSTALLATION RECORD

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Record form (Figure 3.4). This information will become part of the permanent field record for the site.

Monitoring point screens will be constructed of flush-threaded, Schedule 40 PVC with an ID of 0.5 inch. The screens will be factory slotted with 0.01-inch openings. Monitoring point screens will be placed to sample and provide water level information at or near the water table. Blank monitoring point casing will be constructed of Schedule 40 PVC with an ID of 0.5 inch. All monitoring point casing sections will be flush-threaded; joints will not be glued. The casing at each monitoring point will be fitted with a bottom cap and a top cap constructed of PVC.

If subsurface conditions do not permit the boreholes to stay open (i.e., if the formation collapses in the hole), monitoring points constructed of 0.375-inch Teflon® as described in Section 3.2.2.3.1 will be installed. Should 0.5-inch-ID PVC shallow monitoring points not be installed, the only resulting data gap will be the lack of water level information for that particular location. The decision to install 0.5-inch-ID PVC monitoring points will be made in the field once the open-hole stability of subsurface soils and Geoprobe® equipment can be evaluated.

The field scientist will verify and record the total depth of the monitoring point, the lengths of all casing sections, and the depth to the top of all monitoring point completion materials. All lengths and depths will be measured to the nearest 0.1 foot.

3.2.2.4 Monitoring Point Completion or Abandonment

A number of the monitoring points will be completed above grade, and as needed, steel or PVC protective casing will be used to protect the well points from tampering and damage. The number of permanent monitoring points will be determined by the Parsons ES field scientist. The completion of the monitoring points will be similar to those protecting the existing monitoring wells unless otherwise specified by AS personnel.

Those monitoring points not completed with an external protective casing will be abandoned. The PVC casing and screen or Teflon® tubing will be extracted as far as possible and discarded. While holes created with the Geoprobe® in sandy soils similar to those found at CCAS tend to cave in soon after extraction of the drive rod, any test holes remaining open after extraction of the casing will be sealed with bentonite chips, pellets, or grout to eliminate any creation or enhancement of contaminant migration pathways to the groundwater. After monitoring point completion or abandonment, each site will be restored as closely as possible to its original condition.

3.2.3 Monitoring Point Development and Records

The monitoring points will be developed prior to sampling to remove fine sediments from the portion of the formation adjacent to the well point screen. Development will be accomplished using a peristaltic pump provided by USEPA NRMRL or Parsons ES. The pump will be inserted into or attached to the well point, and water will be removed

until DO, pH, temperature, and specific conductivity stabilize. Monitoring point development will occur a minimum of 24 hours prior to sampling.

A development record will be maintained for each monitoring point. The development record will be completed in the field by the field scientist. Figure 3.5 is an example of a development record used for similar well installations. Development records will include:

- Monitoring point number;
- Date and time of development;
- Development method;
- Monitoring point depth;
- Volume of water produced;
- Description of water produced;
- Post-development water level and monitoring point depth; and
- Field analytical measurements, including pH and specific conductivity.

Development waters will be collected and stored in pickup tanks and transferred to holding tanks at the Trident Wastewater Treatment Plant (WWTP). The industrial wastewater will then be disposed of in accordance with Field Sampling Procedures, Volume 2, Of The Program Wide Generic Workplan (Parsons ES, 1995) for the AS. Alternate methods of water disposal will be considered by the Parsons ES field scientist as recommended by AS personnel.

3.2.4 Monitoring Point Location and Datum Survey

The location and elevation of the well points will be surveyed soon after completion. Horizontal coordinates will be measured to the nearest 0.1 foot relative to established Base coordinates. The elevation of the ground surface adjacent to the protective casing will be measured relative to the USGS msl datum. The ground surface elevation will be measured to the nearest 0.1 foot. A top-of-casing datum will be measured to the nearest 0.01 foot for all monitoring points constructed of 0.5-inch PVC casing and well screen. Because water levels cannot be measured through monitoring point tubing, no datum elevation, such as top of casing, will be measured for monitoring points constructed with Teflon® tubing.

3.2.5 Water Level Measurements

Water levels at existing monitoring wells and 0.5-inch PVC monitoring points will be measured within a short time period so that the water level data are comparable.

MONITORING POINT DEVELOPMENT RECORD

Job Number: 729691.29220
Location Cape Canaveral AS
Well Number_______________

Job Name: Facility 1381
by_______________Date: _______, 1996
Measurement Datum_______________

Pre-Development Information

Time (Start):_______________

Water Level:_______________

Total Depth of Well:_______________

Water Characteristics

Color_______________Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material _______________
pH_______________Temperature(°C)_______________
Specific Conductance(µS/cm)_______________

Interim Water Characteristics

Gallons Removed_______________

pH_______________

Temperature (°C)_______________

Specific Conductance(µS/cm)_______________

Post-Development Information

Time (Finish):_______________

Water Level:_______________

Total Depth of Well:_______________

Approximate Volume Removed: _______________

Water Characteristics

Color_______________Clear Cloudy
Odor: None Weak Moderate Strong
Any Films or Immiscible Material _______________
pH_______________Temperature(°C)_______________
Specific Conductance(µS/cm)_______________

Comments:

FIGURE 3.5

MONITORING POINT
DEVELOPMENT RECORD

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The depth to water below the measurement datum will be measured to the nearest 0.01 foot using an electric water level probe or an oil/water interface probe.

3.3 GROUNDWATER SAMPLING PROCEDURES

This section describes the scope of work required for collection of groundwater quality samples. Samples will be collected from site monitoring wells (i.e., previously installed wells) and newly installed groundwater monitoring points. A peristaltic pump or bladder pump with dedicated high-density polyethylene (HDPE) tubing will be used to collect groundwater samples at all wells and monitoring points. A Grundfos® Redi-Flo II® pump may be used for monitoring well purging prior to sampling. In order to maintain a high degree of QC during this sampling event, the procedures described in the following sections will be followed.

Sampling will be conducted by qualified scientists and technicians from Parson ES and the USEPA NRMRL who are trained in the conduct of groundwater sampling, records documentation, and chain-of-custody procedures. In addition, sampling personnel will have thoroughly reviewed this work plan prior to sample acquisition and will have a copy of the work plan available onsite for reference. Groundwater sampling includes the following activities:

- Assembly and preparation of equipment and supplies;
- Inspection of the monitoring well/point integrity including:

  - Protective cover, cap, and lock,

  - External surface seal and pad,

  - Monitoring point stick-up, cap, and datum reference, and

  - Internal surface seal;
- Groundwater sampling, including:

  - Water level and product thickness measurements,

  - Visual inspection of sample water,

  - Monitoring well/point casing evacuation, and

  - Sample collection;
- Sample preservation and shipment, including:

  - Sample preparation,

  - Onsite measurement of physical parameters, and

- Sample labeling;

- Completion of sampling records: and
- Sample disposition.

Detailed groundwater sampling and sample handling procedures are presented in following sections.

3.3.1 Preparation for Sampling

All equipment to be used for sampling will be assembled and properly cleaned and calibrated (if required) prior to arriving in the field. In addition, all record-keeping materials will be gathered prior to leaving the office.

3.3.1.1 Equipment Cleaning

All portions of sampling and test equipment that will contact the sample matrix will be thoroughly cleaned before each use. This includes the Geoprobe™ sampling tools, sampling pumps, nondisposable bailers, water level probe and cable, test equipment for onsite use, and other equipment or portions thereof that will contact the samples. Given the types of sample analyses to be conducted, the following cleaning protocol will be used:

- Wash with potable water and phosphate-free laboratory detergent (HP-II detergent solutions, as appropriate);
- Rinse with potable water;
- Rinse with isopropyl alcohol;
- Rinse with distilled or deionized water; and
- Air dry.

Any deviations from these procedures will be documented in the field scientist's field notebook and on the groundwater sampling record (Figure 3.6).

If precleaned, disposable sampling equipment is used, the cleaning protocol specified above will not be required. Laboratory-supplied sample containers will be cleaned and sealed by the laboratory. The type of container provided and the method of container decontamination will be documented in the USEPA mobile laboratory's permanent record of the sampling event.

3.3.1.2 Equipment Calibration

As required, field analytical equipment will be calibrated according to the manufacturers' specifications prior to field use. This applies to equipment used for

GROUNDWATER SAMPLING RECORD

Sampling Location Cape Canaveral, Facility 1381
Sampling Dates ______

GROUND WATER SAMPLING RECORD - MONITORING WELL ______________________
(number)

REASON FOR SAMPLING: [X] Regular Sampling; [ ] Special Sampling;
DATE AND TIME OF SAMPLING: ____________, 1996 ________ a.m./p.m.
SAMPLE COLLECTED BY: ________ of Parsons ES
WEATHER:______________________
DATUM FOR WATER DEPTH MEASUREMENT (Describe):______________________

MONITORING WELL CONDITION:
[ ] LOCKED: [ ] UNLOCKED
WELL NUMBER (IS - IS NOT) APPARENT
STEEL CASING CONDITION IS:______________________
INNER PVC CASING CONDITION IS:______________________
WATER DEPTH MEASUREMENT DATUM (IS - IS NOT) APPARENT
[ ] DEFICIENCIES CORRECTED BY SAMPLE COLLECTOR
[ ] MONITORING WELL REQUIRED REPAIR (describe):______________________

Check-off

1 [ ] EQUIPMENT CLEANED BEFORE USE WITH______________________
Items Cleaned (List):______________________

2 [ ] PRODUCT DEPTH ______________________FT. BELOW DATUM
Measured with:______________________

WATER DEPTH ______________________FT. BELOW DATUM
Measured with:______________________

3 [ ] WATER-CONDITION BEFORE WELL EVACUATION (Describe):
Appearance:______________________
Odor:______________________
Other Comments:______________________

4 [ ] WELL EVACUATION:
Method:______________________
Volume Removed:______________________
Observations: Water (slightly - very) cloudy
Water level (rose - fell - no change)
Water odors:______________________
Other comments:______________________

FIGURE 3.6

GROUNDWATER SAMPLING RECORD

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Groundwater Sampling Record

Monitoring Well No. _______________ (Cont'd)

5 [ ] SAMPLE EXTRACTION METHOD:

[ ] Bailer made of:______________________________

[ ] Pump, type:_

[ ] Other, describe:______________________________

Sample obtained is [X] GRAB; [ ] COMPOSITE SAMPLE

6 [ ] ON-SITE MEASUREMENTS:

Temp: ________ ° C	Measured with:____________
pH: ____________	Measured with:____________
Conductivity: ________	Measured with:____________
Dissolved Oxygen: ________	Measured with:____________
Redox Potential: ________	Measured with:____________
Salinity: ________	Measured with:____________
Nitrate: ________	Measured with:____________
Sulfate: ________	Measured with:____________
Ferrous Iron: ________	Measured with:____________
Other: ____________	

7 [ ] SAMPLE CONTAINERS (material, number, size):______________________________

8 [ ] ON-SITE SAMPLE TREATMENT:

[ ] Filtration:

Method____________	Containers:____________
Method____________	Containers:____________
Method____________	Containers:____________

[ ] Preservatives added:

Method____________	Containers:____________
Method____________	Containers:____________
Method____________	Containers:____________
Method____________	Containers:____________

9 [ ] CONTAINER HANDLING:

[ ] Container Sides Labeled

[ ] Container Lids Taped

[ ] Containers Placed in Ice Chest

10 [ ] OTHER COMMENTS:______________________________

FIGURE 3.6 (Continued)

GROUNDWATER SAMPLING RECORD

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onsite measurements of DO, pH, electrical conductivity, temperature, ORP, sulfate, nitrate, ferrous iron (Fe^{2+}), and other field parameters listed on Table 3.1.

3.3.2 Well and Monitoring Point Sampling Procedures

Special care will be taken to prevent contamination of the groundwater and extracted samples. The primary way in which sample contamination can occur is through cross-contamination due to insufficient cleaning of equipment between wells and monitoring points. To prevent such contamination, the water level probe and cable used to determine static water levels and total well depths will be thoroughly cleaned before and after field use and between uses at different sampling locations according to the procedures presented in Section 3.3.1.1. Dedicated tubing will be used at each well or monitoring point developed, purged, and/or sampled with the sampling pump. Pumps and nondisposable bailers will be decontaminated according to procedures listed in Section 3.3.1.1. In addition to the use of properly cleaned equipment, a clean pair of new, disposable nitrile or latex gloves will be worn by the sampling personnel each time a different well or monitoring point is sampled.

The following paragraphs present the procedures to be followed for groundwater sample collection from groundwater monitoring wells and monitoring points. These activities will be performed in the order presented below. Exceptions to this procedure will be noted in the field scientist's field notebook or on the groundwater sampling record.

3.3.2.1 Preparation of Location

Prior to starting the sampling procedure, the area around the existing wells and new monitoring points will be cleared of foreign materials, such as brush, rocks, and debris. These procedures will prevent sampling equipment from inadvertently contacting debris around the monitoring well/point.

3.3.2.2 Water Level and Total Depth Measurements

Prior to removing water from the monitoring well or PVC-cased monitoring point, the static water level will be measured. An electric water level probe will be used to measure the depth to groundwater below the datum to the nearest 0.01 foot. After measuring the static water level, the water level probe will be slowly lowered to the bottom of the monitoring well/point, and the depth will be measured to the nearest 0.01 foot. Based on these measurements, the volume of water to be purged from the monitoring well/point will be calculated.

3.3.2.3 Monitoring Well/Point Purging

The volume of water contained within the monitoring well/point casing at the time of sampling will be calculated, and at least three times the calculated volume will be removed from the well/point. A peristaltic pump will be used for monitoring well and monitoring point purging, depth and volume permitting, and a Grundfos Redi-Flo II®

pump, Waterra® inertial pump, or bailer will be used to purge all monitoring wells or points in which a peristaltic pump cannot be used. All purge waters will be collected for proper disposal by the Base.

If a monitoring well/point is evacuated to a dry state during purging, the monitoring well/point will be allowed to recharge, and the sample will be collected as soon as sufficient water is present in the monitoring well/point to obtain the necessary sample quantity. Sample compositing or sampling over a lengthy period by accumulating small volumes of water at different times to obtain a sample of sufficient volume will not be allowed.

3.3.2.4 Sample Extraction

Dedicated HDPE tubing and a peristaltic pump will be used to extract groundwater samples from monitoring wells/points whenever depth to groundwater permits; otherwise, a bladder pump, a Waterra® inertial pump, or a bailer will be used. The tubing, pump, or bailer will be lowered through the casing into the water gently to prevent splashing. The pumping rate will be set low enough so that cavitation does not occur along the length of the HDPE tubing. The sample will be transferred directly into the appropriate sample container. The water will be carefully poured down the inner walls of the sample bottle to minimize aeration of the sample.

Unless other instructions are given by the USEPA mobile laboratory, sample containers will be completely filled so that no air space remains in the container. Excess water collected during sampling will be disposed of in the same manner as purge water.

3.3.2.5 Grab Sampling

In the event monitoring points are not installed, groundwater grab samples will be collected using the Geoprobe® apparatus. To collect these samples, a properly decontaminated, screened probe tip will be driven to the desired sampling depth. As it is driven to depth, the screen will be protected inside the probe rods. After reaching the desired depth, the outer rods will be withdrawn to expose the screen. Purging and sampling procedures will be identical to those for monitoring points. After sampling, the rods and screen will be withdrawn, and the holes will be abandoned as described in Sections 3.1.4 and 3.2.2.4.

3.3.3 Onsite Groundwater Parameter Measurement

As indicated on Table 3.1, many of the groundwater chemical parameters will be measured onsite by USEPA staff. Some of the measurements will be made with direct-reading meters, while others will be made using a Hach® portable colorimeter in accordance with specific Hach® analytical procedures. These procedures are described in the following subsections.

All glassware or plasticware used in the analyses will have been cleaned prior to sample collection by thoroughly washing with a solution of laboratory-grade, phosphate-free detergent (e.g., Alconox®) and water, and rinsing with isopropyl alcohol and deionized water to prevent interference or cross-contamination between measurements. If concentrations of an analyte are above the range detectable by the titrimetric or colorimetric methods, the analysis will be repeated by diluting the groundwater sample with distilled water until the analyte concentration falls to a level within the range of the method. All rinseate and sample reagents accumulated during groundwater analysis will be collected in glass containers fitted with screw caps. These waste containers will be clearly labeled as to their contents and carefully stored for proper disposal.

3.3.3.1 Dissolved Oxygen Measurements

DO measurements will be made using a meter with a downhole oxygen sensor or a sensor in a flow-through cell before and immediately following groundwater sample acquisition. When DO measurements are taken in monitoring wells/points that have not yet been sampled, the existing monitoring wells/points will be purged until DO levels stabilize. The lowest stable DO reading will be recorded.

3.3.3.2 pH, Temperature, and Specific Conductance

Because the pH, temperature, and specific conductance of a groundwater sample can change significantly within a short time following sample acquisition; these parameters will be measured in the field in unfiltered, unpreserved, "fresh" water collected using the same technique as the samples taken for laboratory analyses. The measurements will be made in a flow-through cell or a clean glass container separate from those intended for laboratory analysis, and the measured values will be recorded in the groundwater sampling record (Figure 3.6).

3.3.3.3 Oxidation/Reduction Potential

The ORP of groundwater is an indication of the relative tendency of a solution to accept or transfer electrons. ORP reactions in groundwater are usually biologically mediated; therefore, the ORP of a groundwater system depends upon and influences rates of biodegradation. ORPs can be used to provide real-time data on the location of the contaminant plume, especially in areas undergoing anaerobic biodegradation. The ORP of a groundwater sample taken inside the contaminant plume should be somewhat less than that taken in the upgradient location.

The ORP of a groundwater sample can change significantly within a short time following sample acquisition and exposure to atmospheric oxygen. As a result, this parameter will be measured in the field in unfiltered, unpreserved, "fresh" water collected by the same technique as the samples taken for laboratory analyses. The measurements will be made as quickly as possible in a clean glass container separate from those intended for laboratory analysis or in a flow-through cell.

3.3.3.4 Alkalinity Measurements

Alkalinity in groundwater helps buffer the groundwater system against acids generated through both aerobic and anaerobic biodegradation processes. Alkalinity of the groundwater sample will be measured in the field by experienced USEPA NRMRL scientists via titrimetric analysis using USEPA-approved Hach® Method 8221 (0 to 5,000 mg/L as calcium carbonate) or a similar method. Alkalinity of the groundwater sample will also be measured in the laboratory using USEPA Method 310.1.

3.3.3.5 Nitrate- and Nitrite-Nitrogen Measurements

Nitrate-nitrogen concentrations are of interest because nitrate can act as an electron acceptor during biodegradation under anaerobic soil or groundwater conditions. Nitrate-nitrogen is also a potential nitrogen source for biomass formation for hydrocarbon-degrading bacteria. Nitrite-nitrogen is an intermediate byproduct in both ammonia nitrification and nitrate reduction in anaerobic environments.

Nitrate- and nitrite-nitrogen concentrations in groundwater will be measured in the field by experienced USEPA NRMRL scientists via colorimetric analysis using a Hach® DR/700 Portable Colorimeter. Nitrate concentrations in groundwater samples will be analyzed after preparation with Hach® Method 8039 (0 to 30.0 mg/L NO_3). Nitrite concentrations in groundwater samples will be analyzed after preparation with USEPA-approved Hach® Method 8507 (0 to 0.35 mg/L NO_2) or a similar method. Alternatively, samples may be submitted for laboratory analysis using USEPA Method 353.1 or its equivalent.

3.3.3.6 Sulfate and Sulfide Sulfur Measurements

Sulfate in groundwater is a potential electron acceptor for biodegradation in anaerobic environments, and sulfide is resultant after sulfate reduction. A USEPA NRMRL scientist will measure sulfate and sulfide concentrations via colorimetric analysis with a Hach® DR/700 Portable Colorimeter after appropriate sample preparation. USEPA-approved Hach® Methods 8051 (0 to 70.0 mg/L SO_4) and 8131 (0.60 mg/L S^{2-}) will be used to prepare samples and analyze sulfate and sulfide concentrations, respectively. Samples may also be submitted for fixed-base laboratory analysis using a method such as Waters Capillary Electrophoresis Method N-601 or an equivalent.

3.3.3.7 Total Iron, Ferrous Iron, and Ferric Iron Measurements

Iron is an important trace nutrient for bacterial growth, and different states of iron can affect the ORP of the groundwater and act as an electron acceptor for biological metabolism under anaerobic conditions. Iron concentrations will be measured in the field via colorimetric analysis with a Hach® DR/700 Portable Colorimeter after appropriate sample preparation. Hach® Method 8008 (or similar) for total soluble iron (0 to 3.0 mg/L Fe^{3+} + Fe^{2+}) and Hach® Method 8146 (or similar) for ferrous iron (0

to 3.0 mg/L Fe^{2+}) will be used to prepare and quantitate the samples. Ferric iron will be quantitated by subtracting ferrous iron levels from total iron levels.

3.3.3.8 Manganese Measurements

Manganese is a potential electron acceptor under anaerobic environments. Manganese concentrations will be quantitated in the field using colorimetric analysis with a Hach® DR/700 Portable Colorimeter. USEPA-approved Hach® Method 8034 (0 to 20.0 mg/L Mn) or similar will be used for quantitation of manganese concentrations.

3.3.3.9 Carbon Dioxide Measurements

Carbon dioxide concentrations are of interest because carbon dioxide is a byproduct of all biodegradation reactions. In addition, carbon dioxide in groundwater is a potential electron acceptor for methanogenic biodegradation under anaerobic conditions. Carbon dioxide concentrations in groundwater will be measured in the field by USEPA NRMRL scientists via titrimetric analysis using Hach® Method 1436-01 (0 to 250 mg/L as CO_2).

3.4 SAMPLE HANDLING FOR LABORATORY ANALYSIS

This section describes the handling of samples from the time of sampling until the samples are delivered to USEPA field laboratory.

3.4.1 Sample Preservation

The USEPA laboratory support personnel will add any necessary chemical preservatives prior to filling the sample containers. Samples will be prepared for transportation to the analytical laboratory by placing the samples in a cooler containing ice to maintain a shipping temperature of as close to 4 degrees centigrade (°C) as possible. Samples will be delivered promptly to USEPA field laboratory personnel, who will be responsible for shipment of appropriate samples to the NRMRL in Ada, Oklahoma for fixed-base analysis.

3.4.2 Sample Container and Labels

Sample containers and appropriate container lids will be provided by the USEPA field laboratory (see Appendix B). The sample containers will be filled as described in Sections 3.1.2 and 3.3.2.4, and the container lids will be tightly closed. The sample label will be firmly attached to the container side, and the following information will be legibly and indelibly written on the label:

- Facility name;
- Sample identification;
- Sample type (e.g., groundwater, soil);

- Sampling date;
- Sampling time;
- Preservatives added;
- Sample collector's initials, and
- Analyses requested.

3.4.3 Sample Shipment

After the samples are sealed and labeled, they will be packaged for transport to the onsite USEPA field laboratory. The packaged samples will be delivered by hand to the USEPA field laboratory. Delivery will occur as soon as possible after sample acquisition.

The following packaging and labeling procedures will be followed:

- Package sample so that it will not leak, spill, or vaporize from its container;
- Cushion samples to avoid breakage; and
- Add ice to container to keep samples cool.

USEPA personnel will be responsible for repackaging and overnight shipment of samples to the NRMRL in Ada, Oklahoma.

3.4.4 Chain-of-Custody Control

Chain-of-custody documentation for the shipment of samples from the USEPA field laboratory to the NRMRL analytical laboratory in Ada, Oklahoma, will be the responsibility of the USEPA field personnel.

3.4.5 Sampling Records

In order to provide complete documentation of the sampling event, detailed records will be maintained by the field scientist. At a minimum, these records will include the following information:

- Sample location (facility name);
- Sample identification;
- Sample location map or detailed sketch;
- Date and time of sampling;

- Sampling method;
- Field observations of
  - Sample appearance, and
  - Sample odor;
- Weather conditions;
- Water level prior to purging (groundwater samples, only);
- Total monitoring well/point depth (groundwater samples, only);
- Sample depth (soil samples, only);
- Purge volume (groundwater samples, only);
- Water level after purging (groundwater samples, only);
- Monitoring well/point condition (groundwater samples, only);
- Sampler's identification;
- Field measurements of pH, temperature, DO, and specific conductivity (groundwater samples, only); and
- Any other relevant information.

Groundwater sampling information will be recorded on a groundwater sampling form. Figure 3.6 is an example of the groundwater sampling record. Soil sampling information will be recorded in the field log book.

3.4.6 Laboratory Analyses

Laboratory analyses will be performed on all groundwater and soil samples as well as the QA/QC samples described in Section 4. The analytical methods for this sampling event are listed in Table 3.1. Prior to sampling, USEPA NRMRL personnel will provide a sufficient number of analyte-appropriate sample containers for the samples to be collected. All containers, preservatives, and shipping requirements will be consistent with USEPA protocol or those listed in Appendix B of this plan.

USEPA laboratory support personnel will specify the necessary QC samples and prepare appropriate QC sample containers. For samples requiring chemical preservation, preservatives will be added to containers by the laboratory or USEPA NRMRL field personnel. Containers, ice chests with adequate padding, and cooling media will be provided by USEPA NRMRL laboratory personnel. Sampling personnel will fill the sample containers and return the samples to the field laboratory.

3.5 AQUIFER TESTING

3.5.1 Slug Tests

Slug tests may be conducted on selected previously installed 2-inch-ID monitoring wells to estimate the hydraulic conductivity of unconsolidated deposits at the site. This information is required to accurately estimate the velocity of groundwater and contaminants in the shallow saturated zone. A slug test is a single-well hydraulic test used to determine the hydraulic conductivity of an aquifer in the immediate vicinity of the tested well. Slug tests can be used for both confined and unconfined aquifers that have a transmissivity of less than 7,000 square feet per day (ft^2/day). Slug testing can be performed using either a rising head or a falling head test; at this site, both methods will be used in sequence.

3.5.1.1 Definitions

- **Hydraulic Conductivity (K).** A quantitative measure of the ability of porous material to transmit water; defined as the volume of water that will flow through a unit cross-sectional area of porous or fractured material per unit time under a unit hydraulic gradient.

- **Transmissivity (T).** A quantitative measure of the ability of an aquifer to transmit water. It is the product of the hydraulic conductivity and the saturated thickness.

- **Slug Test.** Two types of testing are possible: rising head and falling head tests. A slug test consists of adding a slug of water or a solid cylinder of known volume to the well to be tested or removing a known volume of water or cylinder and measuring the rate of recovery of water level inside the well. The slug of a known volume acts to raise or lower the water level in the well.

- **Rising Head Test.** A test used in an individual well within the saturated zone to estimate the hydraulic conductivity of the surrounding formation by lowering the water level in the well and measuring the rate of recovery of the water level. The water level may be lowered by pumping, bailing, or removing a submerged slug from the well.

- **Falling Head Test.** A test used in an individual well to estimate the hydraulic conductivity of the surrounding formation by raising the water level in the well by insertion of a slug or quantity of water, and then measuring the rate of drop in the water level.

3.5.1.2 Equipment

The following equipment will be used to conduct a slug test:

- Teflon®, PVC, or metal slugs;

- Nylon or polypropylene rope;
- Electric water level indicator;
- Pressure transducer/sensor;
- Field logbook/forms; and
- Automatic data-recording instrument (such as the Hermit Environmental Data Logger®, In-Situ, Inc. Model SE1000B, or equivalent).

3.5.1.3 General Test Methods

Slug tests are accomplished by either removing a slug or quantity of water (rising head) or introducing a slug (falling head), and then allowing the water level to stabilize while taking water level measurements at closely spaced time intervals.

Because hydraulic testing will be completed on existing wells, it will be assumed that the wells were properly developed and that water levels have stabilized. Slug testing will proceed only after multiple water level measurements over time show that static water levels are in equilibrium. During the slug test, the water level change should be influenced only by the introduction (or removal) of the slug volume. Other factors, such as inadequate well development or extended pumping may lead to inaccurate results; in addition, slug tests will not be performed on wells with free product. The field scientist will determine when static equilibrium has been reached in the well. The pressure transducer, slugs, and any other downhole equipment will be decontaminated prior to and immediately after the performance of each slug test using the procedures described in Section 3.3.1.1.

3.5.1.4 Falling Head Test

The falling head test is the first step in the two-step slug testing procedure. The following steps describe procedures to be followed during performance of the falling head test.

1. Decontaminate all downhole equipment prior to initiating the test.
2. Open the well. Where wells are equipped with watertight caps, the well should be unsealed at least 24 hours prior to testing to allow the water level to stabilize. The protective casing will remain locked during this time to prevent vandalism.
3. Prepare the aquifer slug test data form (Figure 3.7) with entries for:
   - Borehole/well number,
   - Project number,

Aquifer Test Data Sheet

Location Cape Canaveral, Fac. 1381
Job No. 729691.29220
Water Level________________
Measuring Datum________________
Weather________________
Comments________________

Client AFCEE
Field Scientist________________
Total Well Depth________________
Elevation of Datum________________
Temp________________

Well No.________________
Date________________

Beginning Time	Ending Time	Initial Head Reading	Ending Head Reading	Test Type (Rise/Fall)	File Name	Comments

FIGURE 3.7

AQUIFER TEST
DATA FORM

Facility 1381
Demonstration of RNA
Cape Canaveral Air Station, Florida

PARSONS
ENGINEERING SCIENCE, INC.
Denver, Colorado

- Project name,
- Aquifer testing team,
- Climatic data,
- Ground surface elevation,
- Top of well casing elevation,
- Identification of measuring equipment being used,
- Page number,
- Static water level, and
- Date.

4. Measure the static water level in the well to the nearest 0.01 foot.

5. Lower the decontaminated pressure transducer into the well and allow the displaced water to return to its static level. This can be determined by periodic water level measurements until the static water level in the well is within 0.01 foot of the original static water level.

6. Lower the decontaminated slug into the well to just above the water level in the well.

7. Turn on the data logger and quickly lower the slug below the water table, being careful not to disturb the pressure transducer. Follow the owner's manual for proper operation of the data logger.

8. Terminate data recording when the water level stabilizes in the well. The well will be considered stabilized for termination purposes when it has recovered 80 to 90 percent from the initial displacement.

3.5.1.5 Rising Head Test

After completion of the falling head test, the rising head test will be performed. The following steps describe the rising head slug test procedure.

1. Measure the water level in the well to the nearest 0.01 foot to ensure that it has returned to the static water level.

2. Initiate data recording and quickly withdraw the slug from the well. Follow the owner's manual for proper operation of the data logger.

3. Terminate data recording when the water level stabilizes in the well, and remove the pressure transducer from the well and decontaminate. The well will be considered stabilized for termination purposes when it has recovered 80 to 90 percent from the initial displacement.

3.5.1.6 Slug Test Data Analysis

Data obtained during slug testing will be analyzed using AQTESOLV™ (Geraghty & Miller, Inc., 1994) and the method of Bouwer and Rice (1976) and Bouwer (1989) for unconfined conditions.

SECTION 4

QUALITY ASSURANCE/QUALITY CONTROL

Field QA/QC procedures will include collection of field duplicates and rinseate, field and trip blanks; decontamination of all equipment that contacts the sample medium before and after each use; use of analyte-appropriate containers; and chain-of-custody procedures for sample handling and tracking. All samples to be transferred to the USEPA mobile or fixed-base laboratory for analysis will be clearly labeled to indicate sample number, location, matrix (e.g., groundwater), and analyses requested. Samples will be preserved in accordance with the analytical methods to be used, and sample containers will be packaged in coolers with ice to maintain a temperature of as close to 4 degrees Celsius (°C) as possible.

All field sampling activities will be recorded in a bound, sequentially paginated field notebook in permanent ink. All sample collection entries will include the date, time, sample locations and numbers, notations of field observations, and the sampler's name and signature. Field QC samples will be collected in accordance with the program described below, and as summarized in Table 4.1.

QA/QC sampling will include collection and analysis of duplicate groundwater and replicate soil samples, rinseate blanks, field/trip blanks, and matrix spike samples. Internal laboratory QC analyses will involve the analysis of laboratory control samples (LCSs) and laboratory method blanks (LMBs). QA/QC objectives for each of these samples, blanks, and spikes are described below.

Duplicate water and replicate soil samples will be collected at a frequency of 1 for every 10 or fewer samples of similar matrix. Soil and groundwater samples collected with the Geoprobe® sampler should provide sufficient volume for the required replicate/duplicate analyses. Refer to Table 3.1 and Appendix B for further details on sample volume requirements.

One rinseate sample will be collected for every 20 or fewer groundwater samples collected from existing wells. Because disposable bailers may be used for this sampling event, the rinseate sample will consist of a sample of distilled water poured into a new disposable bailer and subsequently transferred into a sample container provided by the laboratory. Rinseate samples will be analyzed for VOCs only.

A field blank will be collected for every 20 or fewer groundwater samples (both from groundwater monitoring point and groundwater monitoring well sampling events) to assess the effects of ambient conditions in the field. The field blank will consist of a

TABLE 4.1
QA/QC SAMPLING PROGRAM
FACILITY 1381
DEMONSTRATION OF RNA
CAPE CANAVERAL AS, FLORIDA

QA/QC Sample Types	Frequency to be Collected and/or Analyzed	Analytical Methods
Duplicates/Replicates	4 Groundwater and 1 Soil Samples (10%)	VOCs
Rinseate Blanks	2 Samples (5% of Groundwater Samples)	VOCs
Field Blanks	2 Samples (5% of Groundwater Samples)	VOCs
Trip Blanks	One per shipping cooler containing VOC samples	VOCs
Matrix Spike Samples	Once per sampling event	VOCs
Laboratory Control Sample	Once per method per medium	Laboratory Control Charts (Method Specific)
Laboratory Method Blanks	Once per method per medium	Laboratory Control Charts (Method Specific)

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sample of distilled water poured into a laboratory-supplied sample container while sampling activities are underway. The field blank will be analyzed for VOCs.

A trip blank will be analyzed to assess the effects of ambient conditions on sampling results during the transportation of samples. The trip blank will be prepared by the laboratory. A trip blank will be transported inside each cooler which contains samples for VOC analysis. Trip blanks will be analyzed for VOCs.

Matrix spikes will be prepared in the laboratory and used to establish matrix effects for samples analyzed for VOCs. LCSs and LMBs will be prepared internally by the laboratory and will be analyzed each day samples from the site are analyzed. Samples will be reanalyzed in cases where the LCS or LMB are out of the control limits. Control charts for LCSs and LMBs will be developed by the laboratory and monitored for the analytical methods used (see Table 3.1).

SECTION 5

DATA ANALYSIS AND REPORT

Once the data collected during the field effort are assembled, they will be analyzed using a variety of methods. For example, isopleth maps of CAHs, degradation products, and alternate electron acceptors and donors will be used to evaluate the occurrence and mechanisms of biodegradation at the site, using the relationships discussed in Section 2. Surface water data will be analyzed to determine if impact to drainage canals has occurred by contaminated groundwater discharge. Additional procedures, such as the Thiessen method, may be used to estimate contaminant mass in the plume, using data from the latest sampling event and from previous sampling events. The Thiessen method, as presented by Dupont *et al.* (1996a and 1996b), also may be used to evaluate movement of the center of mass of the CAH plume over time. This information will give an indication of how the plume has changed over time, and whether the plume is stable. If it is apparent that contaminant mass is lost over time, then it is highly likely that biodegradation is occurring. Site contaminant data also will be used to estimate rates of contaminant mass loss through biodegradation. Site data also will be used to estimate contaminant flux through specified areas. Where possible, the data also will be applied to estimate the impacts of other ongoing or planned remedial actions (such as air sparging) at Facility 1381.

After data evaluation and analysis, numerical and/or analytical groundwater models will be used to evaluate the fate and transport of CAHs dissolved in groundwater at the site. The contaminant fate and transport modeling effort has four primary objectives: 1) predict the future extent and concentration of dissolved contaminant plumes by modeling the effects of advection, dispersion, sorption, and biodegradation; 2) assess the possible exposure of potential downgradient receptors to contaminant concentrations that exceed levels intended to be protective of human health and the environment; and 3) to predict plume fate and transport that could be expected from engineered remedial alternatives; and 4) to provide technical support for selection of RNA as the best remedial alternative at regulatory negotiations, if appropriate.

The results of the modeling and RNA evaluation will be reported in an appendix as part of the CMS currently being prepared for the site. The appendix will include an assessment of the potential threat to human health and the environment based on modeled contaminant concentrations and distribution and upon completion of potential exposure pathways. A suggested LTM plan with point of compliance well locations and sampling frequencies will be presented if RNA is sufficient to protect human health and the environment at Facility 1381. If RNA is not sufficient to protect human health

and the environment, an additional suggested remedial approach incorporating RNA will be presented. The evaluated remedial approach will consider economic and logistic details of the site that are identified as of fundamental importance in the RFS/CMS. For example, any potential engineered remedial options might require use or modification of the pilot air sparging system currently being constructed/operated at the site to remediate the site in concert with RNA.

SECTION 6

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APPENDIX A

ORGANIC COMPOUNDS DETECTED IN GROUNDWATER

LOCXREF	PHASE	NCOORD	ECOORD	GL msl	TOC msl	Borehole Depth ft. bls	Well Depth ft. bls
381/Landfill Area							
1381-MWS01	SI#2	1504383.31	797422.99	9.17	9.08	18.00	17.00
1381-MWD01	SI#2	1504379.31	797428.44	9.17	9.04	51.00	50.00
1381-MWS02	SI#2	1504368.77	797491.99	9.30	9.14	18.00	17.00
1381-MWD02	RFI	1504365.49	797489.60	9.30	9.15	53.00	51.00
1381-MWS03	RFI	1504588.46	797436.66	8.24	8.38	13.00	13.00
1381-MWD03	RFI	1504588.38	797440.25	8.24	8.30	51.50	51.50
1381-MWD04	RFI	1504305.43	797418.48	9.52	12.23	80.00	77.50
1381-MWS05	RFI	1504447.00	797005.30	7.68	11.18	13.00	13.00
1381-MWI05	RFI	1504452.00	797001.80	7.68	11.28	35.00	35.00
1381-MWD05	RFI	1504444.11	797009.79	7.68	10.32	49.50	49.50
1381-MWS06	RFI	1504466.00	797024.70	7.68	10.69	13.00	13.00
1381-MWS07	RFI	1505755.00	797602.10		10.20	13.00	13.00
1381-MWS08	RFI	1504609.52	797903.21	7.17	9.76	13.00	13.00
1381-MWD08	RFI	1504603.00	797900.19	7.38	10.08	48.50	48.50
1381-MWS09	RFI	1504278.21	797469.30	7.45	7.14	13.00	12.50
1381-MWI09	RFI	1504272.57	797478.96	7.22	6.77	36.00	35.00
1381-MWD09	RFI	1504275.71	797474.19	7.14	7.05	50.00	49.80
1381-MWS10	RFI	1504258.18	797671.13	7.97	10.55	13.50	13.50
1381-MWD10	RFI	1504254.48	797674.51	7.97	10.84	50.00	50.00
1381-MWS11	RFI	1504193.92	797178.06	8.08	10.86	14.50	14.50
1381-MWD11	RFI	1504188.81	797182.42	8.33	10.96	50.00	50.00
1381-MWS12	RFI	1505429.89	798083.35	6.88	9.62	14.00	13.50
1381-MWD12	RFI	1505427.46	798088.61	6.96	9.60	50.00	49.50
1381-MWS13	RFI	1505592.71	796624.10	8.24	10.91	13.00	13.00
1381-MWD13	RFI	1505601.33	796626.89	8.62	10.85	50.00	50.00
1381-MWS14	RFI	1506002.99	798494.39	8.23	8.24	14.50	14.50
1381-MWS15	RFI	1506601.74	798915.22	7.79	10.44	15.00	13.50
1381-MWS16	RFI	1505363.75	798696.50	7.81	10.08	13.50	13.00
1381-MWS17	RFI	1504627.62	797234.30	8.70	8.51	15.30	14.80
1381-MWD17	RFI	1504631.56	797229.40	8.72	8.48	52.00	50.50
1381-MWS18	RFI	1504099.04	797568.54	6.65	9.16	13.00	12.50
1381-MWD19	RFI	1505327.27	797182.71	5.29	7.86	50.00	49.50
1381-PZ01	RFI	1504087.54	797374.32	8.12	10.29	13.00	12.50
1381-PZ02	RFI	1504101.25	797389.02	7.66	10.39	13.00	12.50
1381-PZ03	RFI	1506395.65	796890.28	8.97	11.75	13.00	12.50
MW0STAFF2	WESTINDA	1505594.18	795818.87		0.52		
MW0STAFF3	EAST1381	1504322.81	797118.86		0.55		
STILLING GAUGE		1504436.00	796998.00		5.90		
LFMW-1 old		1502840.56	797178.48	8.96	12.22		13.21
LFMW-4 old		1504351.08	795173.14	10.21	13.78		
LFMW-5 old		1506332.98	794385.85	7.31	8.46		14.02
LFMW-6 old		1505631.78	793395.05	6.74	7.91		19.02
LFMW-7 old		1505050.36	796313.77	8.12	10.91		
LFMW-A-S (LF-MWA01)		1505400.64	795920.54	10.99	13.47	23.60	23.60
LFMW-A-D (LF-MWA02)		1505393.49	795926.75	10.93	13.44	50.00	50.00
LFMW-B-S (MWB01)		1505057.93	796286.79	9.35	11.83	24.10	24.10
LFMW-B-I (LF-MWB02)		1505049.73	796293.74	9.25	11.59	38.70	38.70
LFMW-C-S (LF-MWC01)		1504717.53	796627.80	8.83	11.24	23.70	23.70
LFMW-C-I (LF-MWC02)		1504711.76	796633.73	8.85	11.33	35.00	35.00
LFMW-C-D (LF-MWC03)		1504705.82	796639.42	8.88	11.16	50.00	50.00
LFMW-D-S (LF-MWD01)		1504397.11	796981.65	7.89	10.49	23.70	23.70
LFMW-D-D (LF-MWD02)		1504391.41	796988.05	8.03	10.67	51.00	51.00
LFMW-E-S (LFE03)		1503309.74	796348.25	9.32	12.26	24.00	24.00
LFMW-E-I (LFE02)		1503306.69	796353.29	9.27	12.02	38.50	38.50
LFMW-E-D (LFE01)		1503304.30	796358.15	9.01	11.87	53.60	53.50
LFMW-F-S		1505359.72	795235.47	8.47	11.63		18.21
LFMW-G-S		1504937.99	794839.62	9.16	11.84		17.55
LFMW-H-S		1504672.65	794888.86	8.20	11.54		18.05
LFMW-H-I		1504665.42	794886.38	8.41	11.18		37.32
LFMW-H-D		1504658.13	794884.20	8.61	10.76		51.03
LFMW-I-S		1504360.77	795091.71	11.91	14.93		22.16
LFMW-J-S		1504052.61	795640.47	9.14	12.06		16.58
LFMW-K-S		1503528.31	796256.00	8.11	10.50		18.79

	LOCXREF	Screen Top ft. bls	Screen Length ft.	Screen Bottom ft.	Lock Type	Key Type	Well Type	Well Dia. in.
381/Landfill Area								
S	1381-MWS01	5.00	10.00	15.00	ES	ES	F	2.00
D	1381-MWD01	38.00	10.00	48.00	ES	ES	F	2.00
	1381-MWS02	5.00	10.00	15.00	ES	ES	F	2.00
	1381-MWD02	46.00	5.00	51.00	ES	ES	F	2.00
	1381-MWS03	3.00	10.00	13.00	ES	ES	F	2.00
D	1381-MWD03	46.50	5.00	51.50	ES	ES	F	2.00
D	1381-MWD04	72.50	5.00	77.50	ES	ES	AG	2.00
	1381-MWS05	3.00	10.00	13.00			AG	2.00
	1381-MWI05	30.00	5.00	35.00			AG	2.00
	1381-MWD05	44.00	5.00	49.00			AG	2.00
S	1381-MWS06	3.00	10.00	13.00			AG	2.00
S	1381-MWS07	3.00	10.00	13.00			AG	2.00
	1381-MWS08	3.00	10.00	13.00			AG	2.00
	1381-MWD08	43.00	5.00	48.00			AG	2.00
S	1381-MWS09	7.50	5.00	12.50			F	2.00
I	1381-MWI09	30.00	5.00	35.00				2.00
	1381-MWD09	44.80	5.00	49.80			F	2.00
	1381-MWS10	3.00	10.00	13.00			AG	2.00
	1381-MWD10	44.50	5.00	49.50			AG	2.00
S	1381-MWS11	4.00	10.00	14.00			AG	2.00
D	1381-MWD11	44.50	5.00	49.50			AG	2.00
	1381-MWS12	3.00	10.00	13.00			AG	2.00
	1381-MWD12	44.00	5.00	49.00			AG	2.00
	1381-MWS13	2.50	10.00	12.50			AG	2.00
D	1381-MWD13	44.50	5.00	49.50			AG	2.00
S	1381-MWS14	4.00	10.00	14.00			F	2.00
	1381-MWS15	3.00	10.00	13.00			AG	2.00
	1381-MWS16	3.00	10.00	13.00				2.00
S	1381-MWS17	4.80	10.00	14.80				2.00
D	1381-MWD17	45.50	5.00	50.50				2.00
S	1381-MWS18	2.50	10.00	12.50				2.00
	1381-MWD19	44.50	5.00	49.50				2.00
S	1381-PZ01	2.50	10.00	12.50				2.00
S	1381-PZ02	2.50	10.00	12.50				2.00
S	1381-PZ03	2.50	10.00	12.50				2.00
S	MW0STAFF2			Note: Staff gage survey IDs were swapped.				
S	MW0STAFF3			Note: Staff gage survey IDs were swapped.				
	STILLING GA							
S	LFMW-1 old				NA	NA	AG	2.00
	LFMW-4 old							
S	LFMW-5 old				NA	NA	AG	4.00
S	LFMW-6 old				NA	NA	AG	3.00
	LFMW-7 old							
S	LFMW-A-S (L				tumbler	1557	AG	4.00
D	LFMW-A-D (L				tumbler	1557	AG	4.00
S	LFMW-B-S (M				tumbler	1557	AG	4.00
D	LFMW-B-I (LF				tumbler	1557	AG	4.00
S	LFMW-C-S (L				tumbler	1557	AG	4.00
D	LFMW-C-I (LF				tumbler	1557	AG	4.00
D	LFMW-C-D (L				tumbler	1557	AG	4.00
S	LFMW-D-S (L				tumbler	1557	AG	4.00
D	LFMW-D-D (L				tumbler	1557	AG	4.00
S	LFMW-E-S (L				tumbler	1557	AG	4.00
D	LFMW-E-I (LF				tumbler	1557	AG	4.00
D	LFMW-E-D (L				tumbler	1557	AG	4.00
S	LFMW-F-S				EG&G	ML-22	AG	4.00
S	LFMW-G-S				EG&G	ML-22	AG	4.00
S	LFMW-H-S				EG&G	ML-22	AG	4.00
D	LFMW-H-I				EG&G	ML-22	AG	4.00
D	LFMW-H-D				EG&G	ML-22	AG	4.00
S	LFMW-I-S				EG&G	ML-22	AG	4.00
S	LFMW-J-S				EG&G	ML-22	AG	4.00
S	LFMW-K-S				EG&G	ML-22	AG	4.00

LOCXREF	Well Mtl.	Point of Measure	3/12/96 ft. BTOC	3/12/96 ft. msl	3/11/96 ft. BTOC	3/11/96 ft. msl	3/4/96 ft. BTOC
1381/Landfill Area							
1381-MWS01	PVC	TOC	4.78	4.30	5.91	3.17	6.50
1381-MWD01	PVC	TOC	4.84	4.20	5.94	3.10	6.43
1381-MWS02	PVC	TOC	4.81	4.33	5.91	3.23	6.55
1381-MWD02	PVC	TOC	4.86	4.29	6.05	3.10	6.53
1381-MWS03	PVC	TOC	4.04	4.34	4.94	3.44	5.80
1381-MWD03	PVC	TOC	4.13	4.17	5.28	3.02	5.71
1381-MWD04	PVC	TOC	2.27	9.96	2.22	10.01	2.59
1381-MWS05	PVC	TOC	6.69	4.49	7.52	3.66	
1381-MWI05	PVC	TOC	6.27	5.01	7.63	3.65	
1381-MWD05	PVC	TOC	6.84	3.48	7.61	2.71	
1381-MWS06	PVC	TOC	6.27	4.42	6.87	3.82	
1381-MWS07	PVC	TOC	5.67	4.53	6.44	3.76	7.41
1381-MWS08	PVC	TOC	5.36	4.40			7.22
1381-MWD08	PVC	TOC	6.05	4.03			8.08
1381-MWS09	SS	TOC					
1381-MWI09	PVC	TOC					
1381-MWD09	SS	TOC					
1381-MWS10	PVC	TOC	6.38	4.17			8.46
1381-MWD10	PVC	TOC	7.57	3.27			8.63
1381-MWS11	PVC	TOC	6.72	4.14			
1381-MWD11	PVC	TOC	7.00	3.96			
1381-MWS12	PVC	TOC	5.05	4.57			
1381-MWD12	PVC	TOC	5.09	4.51			
1381-MWS13	PVC	TOC					
1381-MWD13	PVC	TOC					
1381-MWS14	PVC	TOC					
1381-MWS15	PVC	TOC					
1381-MWS16	PVC	TOC					
1381-MWS17	PVC	TOC					
1381-MWD17	PVC	TOC					
1381-MWS18	PVC	TOC					
1381-MWD19	PVC	TOC					
1381-PZ01	PVC	TOC					
1381-PZ02	PVC	TOC					
1381-PZ03	PVC	TOC					
MW0STAFF2			3.39	3.91	2.56	3.08	
MW0STAFF3			3.56	4.11	2.78	3.33	
STILLING GA			2.80	3.10	2.58	3.32	
LFMW-1 old	STEEL	TOC	7.57	4.65	8.45	3.77	9.31
LFMW-4 old			9.30	4.48	10.40	3.38	10.64
LFMW-5 old	PVC	TOC	3.70	4.76	4.87	3.59	5.51
LFMW-6 old	PVC	TOC	2.87	5.04	3.35	4.56	4.51
LFMW-7 old			6.91	4.00	7.79	3.12	8.38
LFMW-A-S (L	PVC	TOC	9.23	4.24	10.29	3.18	10.72
LFMW-A-D (L	PVC	TOC	9.57	3.87	9.98	3.46	10.44
LFMW-B-S (M	PVC	TOC	7.53	4.30	7.44	4.39	9.02
LFMW-B-I (LF	PVC	TOC	7.33	4.26	8.26	3.33	8.83
LFMW-C-S (L	PVC	TOC	6.88	4.36	7.69	3.55	8.39
LFMW-C-I (LF	PVC	TOC	6.88	4.45	7.71	3.62	8.40
LFMW-C-D (L	PVC	TOC	6.83	4.33	7.74	3.42	8.35
LFMW-D-S (L	PVC	TOC	6.09	4.40	6.75	3.74	7.58
LFMW-D-D (L	PVC	TOC	6.37	4.30	7.15	3.52	7.78
LFMW-E-S (L	PVC	TOC	-		-		-
LFMW-E-I (LF	PVC	TOC	7.33	4.69	8.60	3.42	9.05
LFMW-E-D (L	PVC	TOC	7.27	4.60	8.56	3.31	8.97
LFMW-F-S	PVC	TOC	7.04	4.59	8.03	3.60	8.65
LFMW-G-S	PVC	TOC	7.01	4.83	8.12	3.72	8.71
LFMW-H-S	PVC	TOC	6.73	4.81	7.83	3.71	8.38
LFMW-H-I	PVC	TOC	6.42	4.76	7.52	3.66	8.05
LFMW-H-D	PVC	TOC	7.11	3.65	7.23	3.53	7.69
LFMW-I-S	PVC	TOC	10.30	4.63	11.53	3.40	11.75
LFMW-J-S	PVC	TOC	7.50	4.56	8.49	3.57	8.99
LFMW-K-S	PVC	TOC	5.72	4.78	6.67	3.83	7.54

Sheet1

LOCXREF	3/4/96 ft. msl	1/30/96 ft. BTOC	1/30/96 ft. msl	1/5/95 ft. BTOC	1/5/95 ft. msl	8/28/95 ft. BTOC	8/28/95 ft. msl
			WATER LEVELS				
381/Landfill Area							
1381-MWS01	2.58	6.60	2.48	6.33	2.75	4.95	4.13
1381-MWD01	2.61	6.55	2.49	6.31	2.73	5.13	3.91
1381-MWS02	2.59	6.65	2.49	6.38	2.76	4.97	4.17
1381-MWD02	2.62	6.68	2.47	6.42	2.73		
1381-MWS03	2.58	5.88	2.50	5.61	2.77		
1381-MWD03	2.59	5.81	2.49	5.65	2.65		
1381-MWD04	9.64	2.42	9.81	2.15	10.08		
1381-MWS05		8.49	2.69				
1381-MWI05		8.51	2.77				
1381-MWD05							
1381-MWS06		7.90	2.79				
1381-MWS07	2.79	7.38	2.82				
1381-MWS08	2.54						
1381-MWD08	2.00						
1381-MWS09							
1381-MWI09							
1381-MWD09							
1381-MWS10	2.09						
1381-MWD10	2.21						
1381-MWS11							
1381-MWD11							
1381-MWS12							
1381-MWD12							
1381-MWS13							
1381-MWD13							
1381-MWS14							
1381-MWS15							
1381-MWS16							
1381-MWS17							
1381-MWD17							
1381-MWS18							
1381-MWD19							
1381-PZ01							
1381-PZ02							
1381-PZ03							
MW0STAFF2		1.78	2.30	1.99	2.51		
MW0STAFF3		1.88	2.43	2.09	2.64		
STILLING GA		3.94	1.96				
LFMW-1 old	2.91	9.26	2.96	9.00	3.22		
LFMW-4 old	3.14	10.54	3.24	10.23	3.55		
LFMW-5 old	2.95	5.47	2.99	5.22	3.24		
LFMW-6 old	3.40	4.37	3.54	4.04	3.87		
LFMW-7 old	2.53	8.54	2.37	8.32	2.59		
LFMW-A-S (L	2.75	10.85	2.62	10.64	2.83		
LFMW-A-D (L	3.00	10.34	3.10	10.46	2.98		
LFMW-B-S (M	2.81	9.17	2.66	8.98	2.85		
LFMW-B-I (LF	2.76	8.98	2.61	8.78	2.81		
LFMW-C-S (L	2.85	8.55	2.69	8.31	2.93		
LFMW-C-I (LF	2.93	8.54	2.79	8.31	3.02		
LFMW-C-D (L	2.81	8.41	2.75	8.24	2.92		
LFMW-D-S (L	2.91	7.79	2.70	7.54	2.95		
LFMW-D-D (L	2.89	7.91	2.76	7.68	2.99		
LFMW-E-S (L		9.25	3.01	8.99	3.27		
LFMW-E-I (LF	2.97	8.97	3.05	8.73	3.29		
LFMW-E-D (L	2.90	8.91	2.96	8.67	3.20		
LFMW-F-S	2.98	8.65	2.98	8.35			
LFMW-G-S	3.13	8.60	3.24	8.24			
LFMW-H-S	3.16	8.25	3.29	7.89			
LFMW-H-I	3.13	7.92	3.26	7.57			
LFMW-H-D	3.07	7.09	3.67	7.46			
LFMW-I-S	3.18	11.61	3.32	11.32			
LFMW-J-S	3.07	8.91	3.15	8.63			
LFMW-K-S	2.96	7.50	3.00	7.19			

	LOCXREF	12/18/95 ft. BTOC	12/18/95 ft. msl	4/4/96 ft. BTOC	4/4/96 ft. msl	NOTES	6/19/96 ft. BTOC	6/19/96 ft. msl	
[redacted]	381/Landfill Area								
S	1381-MWS01	NA		4.58	4.50		4.86	4.22	↓ 0.004545
D	1381-MWD01	NA		4.61	4.43		4.97	4.07	
[redacted]	1381-MWS02	NA		4.62	4.52		4.88	4.26	↓ 0.000519
	1381-MWD02			4.61	4.54		4.91	4.24	
	1381-MWS03			3.82	4.56		4.04	4.34	↑ 0.0012
D	1381-MWD03			3.75	4.55		3.91	4.39	
D	1381-MWD04			2.05	10.18	artesian well	2.31	9.92	
[redacted]	1381-MWS05			6.55	4.63		7.00	4.18	↓ 0.0065
	1381-MWI05			6.61	4.67		7.04	4.24	
	1381-MWD05			5.96	4.36		6.39	3.93	
S	1381-MWS06			5.94	4.75		6.35	4.34	
S	1381-MWS07			5.28	4.92		5.56	4.64	
[redacted]	1381-MWS08			5.07	4.69		5.19	4.57	↓ 0.00107
	1381-MWD08			5.38	4.70		5.55	4.53	
	1381-MWS09			2.71	4.43		3.00	4.14	↓ 0.01716
I	1381-MWI09						2.66	4.11	
[redacted]	1381-MWD09			3.44	3.61		3.54	3.51	
	1381-MWS10			6.15	4.40		6.36	4.19	↑ 0.0033
	1381-MWD10			6.31	4.53		6.52	4.32	
S	1381-MWS11			6.51	4.35		6.90	3.96	
D	1381-MWD11			6.62	4.34				
[redacted]	1381-MWS12			4.71	4.91		4.77	4.85	↓ 0.00701
	1381-MWD12			4.63	4.97		5.02	4.58	
	1381-MWS13			6.50	4.41		6.81	4.10	↓ 0.0025
D	1381-MWD13			6.21	4.64		6.85	4.00	
S	1381-MWS14			3.50	4.74		3.66	4.58	
[redacted]	1381-MWS15			6.27	4.17		6.64	3.80	
	1381-MWS16						5.28	4.80	
	1381-MWS17						4.28	4.23	↓ 0.00681
D	1381-MWD17						4.51	3.97	
S	1381-MWS18						4.99	4.17	
[redacted]	1381-MWD19						3.61	4.25	
	1381-PZ01						6.38	3.91	
S	1381-PZ02						6.42	3.97	
S	1381-PZ03						7.84	3.91	
S	MW0STAFF2			3.64		gage read 4.0, ~~actual elevation~~ = 4.52msl (11/14/95)			
[redacted]	MW0STAFF3			3.80		gage read 4.0, ~~actual elevation~~ = 4.55msl (11/14/95)			
	STILLING GA			1.56	4.34				
S	LFMW-1 old			7.15	5.07		7.01	5.21	
	LFMW-4 old			8.28	5.50		8.50	5.28	
S	LFMW-5 old			3.56	4.90		3.94	4.52	
S	LFMW-6 old			3.12	4.79		3.45	4.46	
[redacted]	LFMW-7 old			6.60	4.31		7.10	3.81	
S	LFMW-A-S (L			8.95	4.52		9.44	4.03	
D	LFMW-A-D (L			8.59	4.85		8.15	5.29	
S	LFMW-B-S (M			7.24	4.59		7.71	4.12	
D	LFMW-B-I (LF			7.02	4.57		7.48	4.11	
S	LFMW-C-S (L			6.58	4.66		7.02	4.22	
D	LFMW-C-I (LF			6.58	4.75		7.01	4.32	
D	LFMW-C-D (L			6.47	4.69		6.92	4.24	
S	LFMW-D-S (L			5.84	4.65		6.24	4.25	
D	LFMW-D-D (L			6.02	4.65		6.38	4.29	
S	LFMW-E-S (L			7.13	5.13		7.01	5.25	
D	LFMW-E-I (LF			6.88	5.14		6.75	5.27	
D	LFMW-E-D (L			6.80	5.07		6.69	5.18	
S	LFMW-F-S			6.61	5.02		6.95	4.68	
S	LFMW-G-S			6.49	5.35		6.72	5.12	
S	LFMW-H-S			6.07	5.47		6.29	5.25	
D	LFMW-H-I			5.75	5.43		5.94	5.24	
D	LFMW-H-D			5.72	5.04		5.06	5.70	
S	LFMW-I-S			9.37	5.56		9.57	5.36	
S	LFMW-J-S			6.70	5.36		6.80	5.26	
S	LFMW-K-S			5.33	5.17		5.21	5.29	

TABLE 2.4
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Groundwater and Surface Water Field Measurement Parameters

AFIID	LOCID	LOGDATE (DD-MMM-YY)	LOGTIME (HHMM)	pH (s.u.)	Cond (µmhos)	Turb (NTU)	Temp (deg C)
CAPEC	1381MWS01	15-Dec-95	1020	7.00	1320	22	25.4
CAPEC	1381MWD01	15-Dec-95	1000	7.61	3730	7	24.5
CAPEC	1381MWS02	15-Dec-95	910	7.06	1300	184	24.8
CAPEC	1381MWD02	15-Dec-95	1020	7.67	4110	8	24.4
CAPEC	1381MWS03	15-Dec-95	1300	7.22	970	196	24.0
CAPEC	1381MWD03	15-Dec-95	1405	8.14	3920	17	24.6
CAPEC	1381MWD04	10-Jan-96	1045	7.78	1730	2	22.4
CAPEC	1381MWS05	13-Mar-96	1050	7.01	1490	674	21.5
CAPEC	1381MWI05	13-Mar-96	1015	7.49	3280	0	22.8
CAPEC	1381MWD05	13-Mar-96	1120	8.13	2950	20	23.5
CAPEC	1381MWS07	22-Mar-96	1115	7.20	529	125	21.0
CAPEC	1381MWS08	08-Mar-96	1200	6.96	1290	644	19.9
CAPEC	1381MWD08	08-Mar-96	1415	7.7	5450	0	21.8
CAPEC	1381MWS09	08-Mar-96	1000	7.02	1420	915	20.7
CAPEC	1381MWD09	08-Mar-96	1015	7.62	3590	12	21.7
CAPEC	1381MWS10	12-Mar-96	1420	7.05	1310	84	20.4
CAPEC	1381MWD10	12-Mar-96	1515	7.78	4300	6	21.7
CAPEC	1381MWS11	12-Mar-96	1330	6.89	828	65	21.1
CAPEC	1381MWD11	12-Mar-96	1315	7.49	5550	1	22.5
CAPEC	1381MWD12	13-Mar-96	1515	7.9	3730	2	22.4
CAPEC	1381MWS13	22-Mar-96	0910	7.22	632	999	21.6
CAPEC	1381MWD13	22-Mar-96	1015	7.37	1910	3	23.7
CAPEC	1381MWS15	22-Mar-96	1325	6.93	1040	250	20.5
CAPEC	1381SW02	17-Dec-95	1330	7.19	1930	9	23.2
CAPEC	1381SW03	17-Dec-95	1030	7.17	1930	5	22.2
CAPEC	1381SW04	17-Dec-95	930	6.87	1970	3	21.6
CAPEC	1381SW05	07-Mar-96	1330	7.7	1050	192	24.3
CAPEC	1381SW06	07-Mar-96	1345	7.71	797	62	25.8
CAPEC	1381SW07	07-Mar-96	1445	7.63	779	5	25.4
CAPEC	1381SW08	14-Mar-96	1320	7.26	464	44	15.8

TABLE 3.X

Facility 1381 - Ordnance Support Facility (1381)

Cape Canaveral Air Station, FL

Analytical Data Summary for Groundwater Samples.

PARAMETERS	Screening Level: Level	Screening Level: Source	1381MWS01	1381MWD01	1381MWS02	1381MWD02	1381MWR01
SAMPLE DEPTH:			5-15'	38-48'	5-15'	46-51'	46-51'
SAMPLE DATE:			12/15/95	12/15/95	12/15/95	12/15/95	12/15/95
							Dup of MWD02
SW8260 (UG/L)							
VOLATILE ORGANIC COMPOUNDS BY GC/MS			0464380007SA	0464380006SA	0464380003SA	0464380008SA	0464380005SA
Carbon disulfide	700	GWGC	ND	ND	ND	ND	ND
1,1-Dichloroethene	7	MCL	ND	ND	$\boxed{68 F}$	ND	ND
Total 1,2-Dichloroethene	-	-	8800	ND	3000	38 J	38 J
Trichloroethylene (TCE)	3	MCL	$\boxed{190 F}$	ND	$\boxed{4300}$	$\boxed{3.3}$	2.7
Vinyl Chloride	1	MCL	$\boxed{1300}$	ND	$\boxed{100 F}$	$\boxed{62}$	$\boxed{63}$
Total Xylenes	20	SDWS	ND	3.5	ND	ND	ND
SW8270 (UG/L)							
GC/MS FOR SEMIVOLATILE ORGANICS			0464380007SA	0464380006SA	0464380003SA	0464380008SA	0464380005SA
Naphthalene	6.8	GWGC	ND	ND	1.0 F	ND	ND
SW8310 (UG/L)							
POLYNUCLEAR AROMATIC HYDROCARBONS			0464380007SA	0464380006SA	0464380003SA	0464380008SA	0464380005SA
Acenaphthene	20	GWGC	ND	ND	0.14 F	ND	ND
Fluorene	280	GWGC	0.11 F	ND	0.22	ND	ND
Fluoranthene	280	GWGC	ND	ND	0.14 F	ND	ND
2-Methylnaphthalene	-	-	ND	ND	0.52 F	ND	ND
Naphthalene	6.8	GWGC	ND	ND	1.1 J	ND	ND
Phenanthrene	10	GWGC	ND	ND	0.67	ND	ND
E418.1 (UG/L)							
PETROLEUM HYDROCARBONS, TOTAL RECOVERABLE			NA	NA	NA	NA	NA
Petroleum hydrocarbons	5	FPCC					
SW8080 (UG/L)							
ORGANOCHLORINE PESTICIDES AND PCBS			0464380007SA	NA	0464380003SA	NA	NA
Alpha bhc (alpha hexachlorocyclohexane)	0.05	GWGC	ND		0.020 F		
Delta bhc (delta hexachlorocyclohexane)	0.05	GWGC	ND		$\boxed{0.15}$		

TABLE 3.X

Facility 1381 - Ordnance Support Facility (1381)

Cape Canaveral Air Station, FL

Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background: Shallow	Background: Deep	LOCATION:	1381MWS01	1381MWD01	1381MWS02	1381MWD02	1381MWR01
					SAMPLE DEPTH:	5-15'	38-48'	5-15'	46-51'	46-51'
					SAMPLE DATE:	12/15/95	12/15/95	12/15/95	12/15/95	12/15/95
										Dup of MWD02
SW6010 (UG/L)										
INDUCTIVELY COUPLED PLASMA						0464380007SA	0464380006SA	0464380003SA	0464380008SA	0464380005SA
Silver	100	SDWS	-	-		ND	ND	ND	ND	ND
Aluminum	200	SDWS	4900	300		ND	18.2 F	ND	55.4 F	36.3 F
Barium	2000	MCL	22	30		ND	ND	ND	ND	ND
Calcium	-	-	310000	180000		132000 J	30700 J	118000 J	32000 J	33800 J
Iron	300	SDWS	28450	100		1200	ND	180	270	258
Potassium	-	-	2940	51000		ND	64600 J	ND	64900 J	68300 J
Magnesium	-	-	25400	248000		15100	77200	9040	78700	82300
Manganese	50	SDWS	166	ND		106	ND	40.7	7.1 F	11
Sodium	160000	MCL	83500	1620000		95000	601000	45900	651000	681000
Nickel	100	MCL	ND	ND		ND	ND	ND	ND	7.0 F

Notes:

(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)

FPCC - Florida Petroleum Contamination Site Cleanup Criteria

GWGC - Florida Groundwater Guidance Concentrations

MCL - Maximum Contaminant Level

SDWS - Secondary Drinking Water Standards

(-) - No criterion value assigned

BLS - Below land surface

E - Exceeded calibration range of instrument

F - Estimated value between method detection limit and reporting limit

J - Estimated value above reporting limit

NA - Sample not analyzed for this parameter

ND - Not detected

REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

DRAFT

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Groundwater Samples

DRAFT

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION: SAMPLE DEPTH: SAMPLE DATE:	1381MWS03 3-13' 12/15/95	1381MWR02 3-13' 12/15/95 Dup of MWS03	1381MWD03 46.5-51.5' 12/15/95	1381MWD04 72.5-77.5 1/10/96
SW8260 (UG/L)							
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0464380010SA	0464380009SA	0464380011SA	0467140001SA
Carbon disulfide	700	GWGC		ND	ND	0.61 F	ND
1,1-Dichloroethene	7	MCL		ND	ND	ND	ND
Total 1,2-Dichloroethene	-	-		2500	2700	ND	ND
Trichloroethylene (TCE)	3	MCL		ND	ND	ND	ND
Vinyl Chloride	1	MCL		330	380	ND	ND
Total Xylenes	20	SDWS		ND	ND	ND	ND
SW8270 (UG/L)							
GC/MS FOR SEMIVOLATILE ORGANICS				0464380010SA	0464380009SA	0464380011SA	0467140001SA
Naphthalene	6.8	GWGC		ND	ND	ND	ND
SW8310 (UG/L)							
POLYNUCLEAR AROMATIC HYDROCARBONS				0464380010SA	0464380009SA	0464380011SA	0467140001SA
Acenaphthene	20	GWGC		ND	ND	ND	ND
Fluorene	280	GWGC		0.10 F	ND	ND	ND
Fluoranthene	280	GWGC		ND	ND	ND	ND
2-Methylnaphthalene	-	-		ND	ND	ND	ND
Naphthalene	6.8	GWGC		ND	ND	ND	ND
Phenanthrene	10	GWGC		ND	ND	ND	ND
E418.1 (UG/L)							
PETROLEUM HYDROCARBONS, TOTAL RECOVERABLE				0464380010SA	0464380009SA	NA	NA
Petroleum hydrocarbons	5	FPCC		REJ	REJ		
SW8080 (UG/L)							
ORGANOCHLORINE PESTICIDES AND PCBS				0464380010SA	0464380009SA	NA	0467140001SA
Alpha bhc (alpha hexachlorocyclohexane)	0.05	GWGC		ND	ND		ND
Delta bhc (delta hexachlorocyclohexane)	0.05	GWGC		ND	ND		ND

TABLE 3.X

Facility 1381 - Ordnance Support Facility (1381)

Cape Canaveral Air Station, FL

Analytical Data Summary for Groundwater Samples

DRAFT

PARAMETERS	Screening Level: Level	Screening Level: Source	Background: Shallow	Background: Deep	1381MWS03	1381MWR02	1381MWD03	1381MWD04
SAMPLE DEPTH:					3-13'	3-13'	46.5-51.5'	72.5-77.5
SAMPLE DATE:					12/15/95	12/15/95	12/15/95	1/10/96
						Dup of MWS03		
SW6010 (UG/L)								
INDUCTIVELY COUPLED PLASMA					0464380010SA	0464380009SA	0464380011SA	0467140001SA
Silver	100	SDWS	-	-	ND	ND	4.0 F	ND
Aluminum	200	SDWS	4900	300	205	164	51.6 F	14.4 F
Barium	2000	MCL	22	30	ND	ND	ND	30.6
Calcium	-	-	310000	180000	130000 J	124000 J	23700 J	63500
Iron	300	SDWS	28450	100	2470	2460	180	ND
Potassium	-	-	2940	51000	ND	ND	70000 J	12000
Magnesium	-	-	25400	248000	12700	13000	59500	55000
Manganese	50	SDWS	166	ND	72.7	69.8	6.2 F	ND
Sodium	160000	MCL	83500	1620000	74400	76500	731000	203000 J
Nickel	100	MCL	ND	ND	ND	ND	ND	ND

Notes:

(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)

FPCC - Florida Petroleum Contamination Site Cleanup Criteria

GWGC - Florida Groundwater Guidance Concentrations

MCL - Maximum Contaminant Level

SDWS - Secondary Drinking Water Standards

(-) - No criterion value assigned

BLS - Below land surface

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F - Estimated value between method detection limit and reporting limit

J - Estimated value above reporting limit

NA - Sample not analyzed for this parameter

ND - Not detected

REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1): Shallow	Background (1): Deep	1381MWS05	1381MWR01	1381MWI05	1381MWD05	1381MWS07
SCREENED INTERVAL (feet BLS):					3'-13'	3'-13'	30'-35'	44'-49'	3'-13'
SAMPLE DATE:					3/13/96	3/13/96	3/13/96	3/13/96	3/22/96
						Dup of MWS05			
SW8260 (UG/L)									
VOLATILE ORGANIC COMPOUNDS BY GC/MS					0478170005SA	0478170006SA	0478170004SA	0478170001SA	0479820006SA
Acetone	700	GWGC			ND	ND	ND	ND	ND
Toluene	400	GWGC			ND	ND	ND	ND	ND
Carbon disulfide	700	GWGC			ND	ND	0.44 F	0.58 F	ND
trans-1,2-Dichloroethene	7	MCL			3.3 F	ND	ND	ND	ND
Total 1,2-Dichloroethene	-	-			180 J	140 J	ND	ND	3.1
Methylene chloride	50	MCL			5.4 F	11 F	ND	ND	ND
Trichloroethylene (TCE)	3	MCL			ND	ND	ND	ND	ND
Chloroform	6	GWGC			ND	ND	ND	ND	ND
Vinyl Chloride	1	MCL			98 J	60 J	ND	ND	ND
SW8270 (UG/L)									
GC/MS FOR SEMIVOLATILE ORGANICS					0478170005SA	0478170006SA	0478170004SA	0478170001SA	0479820006SA
Hexachlorobutadiene	15	GWGC			ND	ND	ND	ND	ND
Hexachlorobenzene	1	MCL			ND	ND	ND	ND	ND
Hexachloroethane	10	GWGC			ND	ND	ND	ND	ND
2-Nitroaniline	7.5	GWGC			REJ	REJ	REJ	REJ	ND
SW8310 (UG/L)									
POLYNUCLEAR AROMATIC HYDROCARBONS					0478170005SA	0478170006SA	0478170004SA	0478170001SA	0479820006SA
Acenaphthene	20	GWGC			0.10 F	ND	ND	ND	ND
SW8080 (UG/L)									
ORGANOCHLORINE PESTICIDES AND PCBS					NA	NA	NA	NA	NA
SW6010 (UG/L)									
INDUCTIVELY COUPLED PLASMA					0478170005SA	0478170006SA	0478170004SA	0478170001SA	0479820006SA
Aluminum	100	SDWS	-	-	ND	ND	286	ND	127 J
Barium	2000	MCL	22	30	8.1 F	7.6 F	2.9 F	9.6 F	4.4 F
Calcium	-	-	310,000	180,000	105000	99100	35000	21100	98500
Copper	1000	SDWS	ND	ND	ND	ND	ND	ND	ND
Iron	300	SDWS	28,450	100	2370	2230	460	48.6 F	800 J
Potassium	-	-	2,940	51,000	11000	10500	45000	54400	551 F
Magnesium	-	-	25,400	248,000	23500	22100	63300	43600	6510
Manganese	50	SDWS	166	ND	32.1	27.6	11	ND	20.6
Sodium	160,000	MCL	83,500	1,620,000	196000	185000	537000	454000	21100

Facility 1381 - Ordnance Support Facility (1381)

Cap[redacted]aver[redacted]ir St[redacted], FL

Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level: Level	Screening Level: Source			LOCATION: / SCREENED INTERVAL (feet BLS): / SAMPLE DATE:	1381MWS05 3'-13' 3/13/96	1381MWR01 3'-13' 3/13/96 Dup of MWS05	1381MWI05 30'-35' 3/13/96	1381MWD05 44'-49' 3/13/96	1381MWS07 3'-13' 3/22/96
Nickel	100	MCL	ND	ND		ND	ND	ND	ND	ND
Lead	15	MCL	11	ND		ND	ND	ND	ND	ND
Vanadium	49	MCL	27	14		ND	4.1 F	ND	ND	ND
SW7470 (UG/L)										
MERCURY IN LIQUID WASTE						0478170005SA	0478170006SA	0478170004SA	0478170001SA	0479820006SA
Mercury	2	MCL	-	-		ND	ND	ND	ND	ND
SW7841 (UG/L)										
THALLIUM (AA, FURNACE TECHNIQUE)						0478170005SA	0478170006SA	0478170004SA	0478170001SA	0479820006SA
Thallium	2	MCL	-	-		REJ	REJ	REJ	REJ	ND

Notes:

(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)

Results which exceed screening levels are boxed.

GWGC - Florida Groundwater Guidance Concentrations

MCL - Maximum Contaminant Level

SDWS - Secondary Drinking Water Standards

(-) - No criterion value assigned

BLS - Below land surface

E - Exceeded calibration range of instrument

F - Estimated value between method detection limit and reporting limit

J - Estimated value above reporting limit

NA - Sample not analyzed for this parameter

ND - Not detected

REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1): Shallow	Background (1): Deep	1381MWR01	1381MWS08	1381MWR01	1381MWD08	1381MWS09
SCREENED INTERVAL (feet BLS):					3'-13'	3'-13'	3'-13'	43'-48'	7.5'-12.5'
SAMPLE DATE:					3/22/96	3/8/96	3/8/96	3/8/96	3/8/96
					Dup of MWS07		Dup of MWS08		
SW8260 (UG/L)									
VOLATILE ORGANIC COMPOUNDS BY GC/MS					0479820008SA	0477430004SA	0477430005SA	0477430006SA	0477430001SA
Acetone	700	GWGC			ND	ND	ND	ND	ND
Toluene	400	GWGC			ND	ND	ND	ND	ND
Carbon disulfide	700	GWGC			ND	ND	ND	1.5	ND
trans-1,2-Dichloroethene	7	MCL			ND	ND	ND	ND	ND
Total 1,2-Dichloroethene	-	-			3.4	14	12	ND	3000
Methylene chloride	50	MCL			ND	ND	ND	ND	ND
Trichloroethylene (TCE)	3	MCL			ND	ND	ND	ND	35000
Chloroform	6	GWGC			ND	ND	ND	ND	ND
Vinyl Chloride	1	MCL			ND	12 J	10 J	ND	ND
SW8270 (UG/L)									
GC/MS FOR SEMIVOLATILE ORGANICS					0479820008SA	0477430004SA	0477430005SA	0477430006SA	0477430001SA
Hexachlorobutadiene	15	GWGC			78	ND	ND	ND	ND
Hexachlorobenzene	1	MCL			100	ND	ND	ND	ND
Hexachloroethane	10	GWGC			30 F	ND	ND	ND	ND
2-Nitroaniline	7.5	GWGC			ND	ND	ND	ND	ND
SW8310 (UG/L)									
POLYNUCLEAR AROMATIC HYDROCARBONS					0479820008SA	0477430004SA	0477430005SA	0477430006SA	0477430001SA
Acenaphthene	20	GWGC			ND	ND	ND	ND	ND
SW8080 (UG/L)									
ORGANOCHLORINE PESTICIDES AND PCBS					NA	NA	NA	NA	0477430001SA
									ND
SW6010 (UG/L)									
INDUCTIVELY COUPLED PLASMA					0479820008SA	0477430004SA	0477430005SA	0477430006SA	0477430001SA
Aluminum	100	SDWS	-	-	106 J	45.1 F	30.6 F	55.5 F	66.9 F
Barium	2000	MCL	22	30	4.7 F	7.1 F	7.1 F	3.6 F	7.8 F
Calcium	-	-	310,000	180,000	99400	144000 J	151000 J	25200 J	142000 J
Copper	1000	SDWS	ND	ND	ND	ND	ND	ND	10.4 F
Iron	300	SDWS	28,450	100	877 J	2180 J	2250 J	112 J	1430 J
Potassium	-	-	2,940	51,000	576 F	2040 F	2190 F	74000	4270 F
Magnesium	-	-	25,400	248,000	6620	16900	17400	93800	22100
Manganese	50	SDWS	166	ND	23.1	46.4	51.8	ND	123
Sodium	160,000	MCL	83,500	1,620,000	21000	92500	96100	1070000 J	132000

Facility 1381 - Ordnance Support Facility (1381)
Cap[redacted]ir S[redacted], FL
Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level			LOCATION:	1381MWR01	1381MWS08	1381MWR01	1381MWD08	1381MWS09
				SCREENED INTERVAL (feet BLS):	3'-13'	3'-13'	3'-13'	43'-48'	7.5'-12.5'
				SAMPLE DATE:	3/22/96	3/8/96	3/8/96	3/8/96	3/8/96
	Level	Source			Dup of MWS07		Dup of MWS08		
Nickel	100	MCL	ND	ND	ND	ND	ND	ND	ND
Lead	15	MCL	11	ND	ND	ND	ND	ND	2.4 F
Vanadium	49	MCL	27	14	ND	ND	ND	ND	ND
SW7470 (UG/L)									
MERCURY IN LIQUID WASTE					0479820008SA	0477430004SA	0477430005SA	0477430006SA	0477430001SA
Mercury	2	MCL	-	-	0.3	ND	ND	ND	ND
SW7841 (UG/L)									
THALLIUM (AA, FURNACE TECHNIQUE)					0479820008SA	0477430004SA	0477430005SA	0477430006SA	0477430001SA
Thallium	2	MCL	-	-	ND	ND	1.3 F	1.3 F	$\boxed{2.0\ F}$

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
Results which exceed screening levels are boxed.
GWGC - Florida Groundwater Guidance Concentrations
MCL - Maximum Contaminant Level
SDWS - Secondary Drinking Water Standards
(-) - No criterion value assigned
BLS - Below land surface
E - Exceeded calibration range of instrument
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

Facility 13[redacted] Ord[redacted] Sup[redacted] Faci[redacted] 1381)
Cape Canaveral Air Station, FL
Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1): Shallow	Background (1): Deep	1381MWD09	1381MWS10	1381MWD10	1381MWS11	1381MWD11
LOCATION:					1381MWD09	1381MWS10	1381MWD10	1381MWS11	1381MWD11
SCREENED INTERVAL (feet BLS):					44.8'-49.8'	3'-13'	44.5'-49.5'	4'-14'	44.5'-49.5'
SAMPLE DATE:					3/8/96	3/12/96	3/12/96	3/12/96	3/12/96
SW8260 (UG/L)									
VOLATILE ORGANIC COMPOUNDS BY GC/MS					0477430003SA	0478030004SA	0478030005SA	0478030003SA	0478030002SA
Acetone	700	GWGC			ND	ND	ND	ND	ND
Toluene	400	GWGC			ND	ND	ND	ND	ND
Carbon disulfide	700	GWGC			ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	7	MCL			ND	ND	1.4 J	ND	ND
Total 1,2-Dichloroethene	-	-			2.4 F	ND	ND	ND	ND
Methylene chloride	50	MCL			ND	ND	ND	ND	ND
Trichloroethylene (TCE)	3	MCL			65	ND	ND	ND	ND
Chloroform	6	GWGC			ND	ND	ND	ND	ND
Vinyl Chloride	1	MCL			ND	2.3	0.50 F	ND	ND
SW8270 (UG/L)									
GC/MS FOR SEMIVOLATILE ORGANICS					0477430003SA	0478030004SA	0478030005SA	0478030003SA	0478030002SA
Hexachlorobutadiene	15	GWGC			ND	ND	ND	ND	ND
Hexachlorobenzene	1	MCL			ND	ND	ND	ND	ND
Hexachloroethane	10	GWGC			ND	ND	ND	ND	ND
2-Nitroaniline	7.5	GWGC			ND	ND	ND	ND	ND
SW8310 (UG/L)									
POLYNUCLEAR AROMATIC HYDROCARBONS					0477430003SA	0478030004SA	0478030005SA	0478030003SA	0478030002SA
Acenaphthene	20	GWGC			ND	ND	ND	ND	ND
SW8080 (UG/L)									
ORGANOCHLORINE PESTICIDES AND PCBS					NA	NA	NA	NA	NA
SW6010 (UG/L)									
INDUCTIVELY COUPLED PLASMA					0477430003SA	0478030004SA	0478030005SA	0478030003SA	0478030002SA
Aluminum	100	SDWS	-	-	17.6 F	84.5 F	33.0 F	75.9 F	18.2 F
Barium	2000	MCL	22	30	5.5 F	11.9	2.4 F	9.1 F	5.1 F
Calcium	-	-	310,000	180,000	46600 J	136000	29300	144000	30000
Copper	1000	SDWS	ND	ND	ND	ND	ND	ND	ND
Iron	300	SDWS	28,450	100	52.4 F	1440	120	987	82.2 F
Potassium	-	-	2,940	51,000	69300	4260 F	69900	6110	83900
Magnesium	-	-	25,400	248,000	84300	15000	76100	17900	105000
Manganese	50	SDWS	166	ND	7.4 F	52.7	ND	54.7	5.0 F
Sodium	160,000	MCL	83,500	1,620,000	639000	120000	808000	50300	1050000 J

Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level				LOCATION:	1381MWD09	1381MWS10	1381MWD10	1381MWS11	1381MWD11
					SCREENED INTERVAL (feet BLS):	44.8'-49.8'	3'-13'	44.5'-49.5'	4'-14'	44.5'-49.5'
	Level	Source			SAMPLE DATE:	3/8/96	3/12/96	3/12/96	3/12/96	3/12/96
Nickel	100	MCL	ND	ND		ND	15.4 F	ND	ND	ND
Lead	15	MCL	11	ND		ND	ND	ND	ND	ND
Vanadium	49	MCL	27	14		ND	ND	ND	7.7 F	ND
SW7470 (UG/L)										
MERCURY IN LIQUID WASTE						0477430003SA	0478030004SA	0478030005SA	0478030003SA	0478030002SA
Mercury	2	MCL	-	-		1.2	ND	ND	ND	ND
SW7841 (UG/L)										
THALLIUM (AA, FURNACE TECHNIQUE)						0477430003SA	0478030004SA	0478030005SA	0478030003SA	0478030002SA
Thallium	2	MCL	-	-		ND	REJ	REJ	REJ	REJ

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program
(BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
Results which exceed screening levels are boxed.
GWGC - Florida Groundwater Guidance Concentrations
MCL - Maximum Contaminant Level
SDWS - Secondary Drinking Water Standards
(-) - No criterion value assigned
BLS - Below land surface
E - Exceeded calibration range of instrument
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1): Shallow	Background (1): Deep	1381MWD12	1381MWS13	1381MWD13	1381MWS15
SCREENED INTERVAL (feet BLS):					44'-49'	2.5'-12.5'	44.5'-49.5'	3'-13'
SAMPLE DATE:					3/13/96	3/22/96	3/22/96	3/22/96
SW8260 (UG/L)								
VOLATILE ORGANIC COMPOUNDS BY GC/MS					0478170002SA	0479820002SA	0479820005SA	0479820007SA
Acetone	700	GWGC			ND	ND	ND	4.5 F
Toluene	400	GWGC			3.8	ND	ND	ND
Carbon disulfide	700	GWGC			REJ	REJ	0.64 F	ND
trans-1,2-Dichloroethene	7	MCL			ND	ND	ND	ND
Total 1,2-Dichloroethene	-	-			ND	0.77 F	ND	18
Methylene chloride	50	MCL			ND	ND	ND	ND
Trichloroethylene (TCE)	3	MCL			ND	ND	ND	ND
Chloroform	6	GWGC			ND	ND	ND	ND
Vinyl Chloride	1	MCL			ND	ND	ND	1.5 F
SW8270 (UG/L)								
GC/MS FOR SEMIVOLATILE ORGANICS					0478170002SA	0479820002SA	0479820005SA	0479820007SA
Hexachlorobutadiene	15	GWGC			ND	ND	ND	ND
Hexachlorobenzene	1	MCL			ND	ND	ND	ND
Hexachloroethane	10	GWGC			ND	ND	ND	ND
2-Nitroaniline	7.5	GWGC			REJ	ND	ND	ND
SW8310 (UG/L)								
POLYNUCLEAR AROMATIC HYDROCARBONS					0478170002SA	0479820002SA	0479820005SA	0479820007SA
Acenaphthene	20	GWGC			ND	ND	ND	ND
SW8080 (UG/L)								
ORGANOCHLORINE PESTICIDES AND PCBS					NA	NA	NA	NA
SW6010 (UG/L)								
INDUCTIVELY COUPLED PLASMA					0478170002SA	0479820002SA	0479820005SA	0479820007SA
Aluminum	100	SDWS	-	-	ND	79.5 F	74.8 F	62.1 F
Barium	2000	MCL	22	30	4.2 F	5.0 FJ	13	6.7 F
Calcium	-	-	310,000	180,000	18500	94200	46200	123000
Copper	1000	SDWS	ND	ND	ND	ND	ND	ND
Iron	300	SDWS	28,450	100	78.6 F	391 J	113 J	400 J
Potassium	-	-	2,940	51,000	58100	3580 F	47100	3160 F
Magnesium	-	-	25,400	248,000	43100	10700	53500	13500
Manganese	50	SDWS	166	ND	ND	72.4	14.6	39.2
Sodium	160,000	MCL	83,500	1,620,000	722000	49600	229000	85200

Phase IV - Analytical Data Summary for Groundwater Samples

PARAMETERS	Screening Level				LOCATION:	1381MWD12	1381MWS13	1381MWD13	1381MWS15
					SCREENED INTERVAL (feet BLS):	44'-49'	2.5'-12.5'	44.5'-49.5'	3'-13'
					SAMPLE DATE:	3/13/96	3/22/96	3/22/96	3/22/96
	Level	Source							
Nickel	100	MCL	ND	ND		ND	ND	ND	ND
Lead	15	MCL	11	ND		ND	ND	ND	ND
Vanadium	49	MCL	27	14		4.9 F	7.9 F	ND	7.1 F
SW7470 (UG/L)									
MERCURY IN LIQUID WASTE						0478170002SA	0479820002SA	0479820005SA	0479820007SA
Mercury	2	MCL	-	-		ND	ND	ND	0.35
SW7841 (UG/L)									
THALLIUM (AA, FURNACE TECHNIQUE)						0478170002SA	0479820002SA	0479820005SA	0479820007SA
Thallium	2	MCL	-	-		REJ	ND	ND	ND

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
Results which exceed screening levels are boxed.
GWGC - Florida Groundwater Guidance Concentrations
MCL - Maximum Contaminant Level
SDWS - Secondary Drinking Water Standards
(-) - No criterion value assigned
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E - Exceeded calibration range of instrument
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J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

LEVEL II [redacted]ropu[redacted] VOC [redacted]ULTS [redacted] RFI
Cape Canaveral Air Station - Facility 1381

LOCID	Depth	Date Sampled	Acetone	Benzene	Toluene	Carbon Disulfide	Chlorobenzene	1,4-Dichlorobenzene	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,2-DCPA	Ethyl-benzene	Trichloro-fluoromethane	Dichloro-difluoromethane	Methylene Chloride	PCE	1,1,1-TCA	1,1,2-TCA	TCE	Chloroform	Vinyl Chloride	XYLENES
1381HP011	S	10/30/95	140	-	-	12	-	-	9.1	-	9.1	5230	56	-	-	-	-	-	-	-	-	-	-	1180	-
1381HP012	D	10/31/95	-	-	-	-	-	-	5.3	-	5.3	2200	11	-	-	-	-	-	-	-	-	-	-	530	-
1381HP021	S	10/31/95	-	-	-	6.3	-	-	5.8	-	5.8	3360	26	-	-	-	-	-	-	-	-	870	-	34	-
1381HP022	D	10/31/95	-	-	-	-	-	-	-	-	-	1010	-	-	-	-	-	-	-	-	-	120	-	110	-
1381HP031	S	10/31/95	69	-	-	-	-	-	-	-	-	2350	21	-	-	-	-	-	-	-	-	370	-	200	-
1381HP032	D	10/31/95	-	-	16	5.5	-	-	14	3.7	14	6730	110	3.7	8	170	-	57	9.7	23	-	13267	21	290	3
1381HP041	S	11/1/95	-	-	-	-	-	-	-	-	-	920	8	-	-	-	-	-	-	-	-	1250	-	58	-
1381HP042	D	11/1/95	-	1.2	12	-	-	-	8.5	10	8.5	2720	160	10	3.8	180	-	370	6.7	5.3	11	10890	27	87	18
1381HP051	S	11/15/95	60	-	-	23	-	-	-	-	-	81	-	-	-	-	-	-	-	-	-	-	-	74	-
1381HP052	D	11/15/95	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
1381HP061	S	11/16/95	-	-	-	-	-	-	-	-	-	1060	6	-	-	-	17	-	-	-	-	15	-	96	-
1381HP062	D	11/16/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
1381HP071	S	11/16/95	-	-	-	-	-	-	-	-	-	5100	-	-	-	-	-	-	-	-	-	-	-	560	-
1381HP072	D	11/16/95	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP081	S	11/27/95	-	-	-	28	-	-	-	-	-	440	-	-	-	-	-	-	-	-	-	-	-	130	-
1381HP082	D	11/27/95	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	-
1381HP091	S	11/17/95	-	-	-	13	-	-	4.8	-	4.8	1010	9.1	-	-	-	-	-	-	-	-	-	-	720	-
1381HP09A1	D	11/17/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP101	S	11/17/95	-	-	-	3.9	-	-	6.5	-	6.5	3730	26	-	-	-	100	-	-	-	-	51	-	210	-
1381HP102	D	11/17/95	190	-	-	-	-	-	-	-	-	47	-	-	-	-	-	-	-	-	-	-	-	1.8	-
1381HP111	S	11/17/95	-	-	-	12	-	-	-	-	-	400	7.4	-	-	-	-	-	-	-	-	-	-	160	-
1381HP112	D	11/17/95	-	-	-	2.9	-	-	-	-	-	86	-	-	-	-	-	-	-	-	-	-	-	9.3	-
1381HP121	S	11/27/95	-	-	-	-	-	-	6.7	-	6.7	1630	12	-	-	-	-	-	-	-	-	-	-	1080	-
1381HP122	D	11/27/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.7	-	1	-
1381HP131	S	12/15/95	-	-	-	-	-	-	4.1	-	4.1	1000	21	-	-	-	-	-	-	-	-	-	-	870	-
1381HP132	D	12/15/95	-	-	-	5.1	-	-	2.7	-	2.7	4190	240	-	-	-	-	-	-	-	-	-	-	2010	-
1381HP141	S	12/1/95	-	-	-	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP142	D	12/1/95	-	-	-	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP151	S	12/2/95	-	-	-	160	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP152	D	12/2/95	-	-	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP161	S	12/5/95	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP162	D	12/5/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP171	S	12/5/95	-	-	-	-	-	-	-	-	-	110	18	-	-	-	-	-	-	-	-	-	-	260	-
1381HP172	D	12/5/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP181	S	12/15/95	-	-	-	-	-	-	-	-	-	96	-	-	-	-	-	-	-	-	-	-	-	22	-
1381HP182	D	12/15/95	-	-	-	5.2	-	-	-	-	-	42	-	-	-	-	-	-	-	-	-	-	-	11	-
1381HP191	S	12/20/95	-	-	-	-	-	-	-	-	-	63	-	-	-	-	-	-	-	-	-	-	-	11	-
1381HP192	D	12/20/95	-	-	-	-	-	-	-	-	-	17	-	-	-	-	-	-	-	-	-	-	-	3.2	-
1381HP201	S	12/21/95	-	-	-	-	-	-	-	-	-	140	8.3	-	-	-	-	-	-	-	-	-	-	95	-

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o:\at509\eng\rfi\1381\HP-VOC.XLS

7/30/96 11:25 AM

LEVEL II Hydropunch VOC RESULTS FOR RFI
Cape Canaveral Air Station - Facility 1381

LOCID	Depth	Date Sampled	Acetone	Benzene	Toluene	Carbon Disulfide	Chlorobenzene	1,4-Dichlorobenzene	1,1-DCA	1,2-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	1,2-DCPA	Ethyl-benzene	Trichloro-fluoromethane	Dichloro-difluoromethane	Methylene Chloride	PCE	1,1,1-TCA	1,1,2-TCA	TCE	Chloroform	Vinyl Chloride	XYLENES
1381HP202	D	12/21/95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.7	-
1381HP221	S	1/11/96	-	-	-	-	-	-	2.5	-	2.5	670	11	-	-	-	-	-	-	-	-	-	-	240	-
1381HP222	D	1/11/96	-	-	-	-	-	-	-	-	-	270	-	-	-	-	-	-	-	-	-	-	-	98	-
1381HP231	S	1/11/96	-	-	-	-	-	-	-	-	-	29	-	-	-	-	-	-	-	-	-	-	-	6.2	-
1381HP232	D	1/11/96	-	-	-	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP241	S	1/11/96	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP242	D	1/11/96	-	-	-	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP251	S	1/19/96	-	-	-	-	-	-	-	-	-	400	-	-	-	-	-	-	-	-	-	-	-	97	-
1381HP252	D	1/19/96	-	-	-	2.3	-	-	-	-	-	130	-	-	-	-	-	-	-	-	-	-	-	110	-
1381HP261	S	1/19/96	-	-	-	-	-	-	3.3	-	-	1540	30	-	-	-	-	-	-	-	-	-	-	1090	-
1381HP262	D	1/19/96	-	-	-	3.4	-	-	-	-	-	140	-	-	-	-	-	-	-	-	-	-	-	76	-
1381HP271	S	1/23/96	-	-	-	4.3	-	-	-	-	-	18	-	-	-	-	-	-	-	-	-	-	-	3	-
1381HP272	D	1/23/96	-	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP281	S	1/23/96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP282	D	1/23/96	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP291	S	1/23/96	-	-	-	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP292	D	1/23/96	-	-	-	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HP301	S	1/24/96	-	-	-	-	-	-	-	-	-	250	-	-	-	-	-	-	-	-	-	-	-	33	-
1381HP302	D	1/24/96	-	-	-	-	-	-	-	-	-	72	-	-	-	-	-	-	-	-	-	-	-	18	-
1381HP311	S	1/24/96	-	-	-	-	-	-	-	-	-	84	-	-	-	-	-	-	-	-	-	-	-	100	-
1381HP312	D	1/24/96	-	-	-	-	-	-	-	-	8.7	4430	29	-	-	-	-	-	-	-	-	870	-	570	-
1381HP321	S	1/25/96	-	-	-	3.6	-	-	-	-	-	24	-	-	-	-	-	-	-	-	-	-	-	4.2	-
1381HP322	D	1/25/96	-	-	-	14	-	-	-	-	-	8.4	-	-	-	-	-	-	-	-	-	-	-	1.4	-
1381HPMWS08	S	2/21/96	-	-	-	16	-	-	-	-	-	210	-	-	-	-	-	-	-	-	-	-	-	72	-
1381HPMWD08	D	2/21/96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2	-
1381HPMWD10	D	3/1/96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1381HPMWS12	S	3/3/96	-	-	-	-	-	-	-	-	-	970	14	-	-	-	-	-	-	-	-	-	-	270	-
1381HPMWD12	D	3/4/96	-	-	-	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

S = Shallow (< 20')

I = Intermediate (from 20' to 40')

D = Deep (> 40')

Results are in ug/L

"-" = Non-detect

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Surface Water Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background: Banana River	Background: Freshwater	1381SW02	1381SW03	1381SW04
LOCATION:					1381SW02	1381SW03	1381SW04
SAMPLE DEPTH:					0	0	0
SAMPLE DATE:					12/17/95	12/17/95	12/17/95
SW8260 (UG/L)							
VOLATILE ORGANIC COMPOUNDS BY GC/MS					0464740006SA	0464740005SA	0464740004SA
Total 1,2-Dichloroethene	-	-			ND	290	210
Trichloroethylene (TCE)	-	-			ND	87	71
Vinyl Chloride	-	-			ND	38	27
SW8270 (UG/L)							
GC/MS FOR SEMIVOLATILE ORGANICS					0464740006SA	0464740005SA	0464740004SA
					ND	ND	ND
SW8310 (UG/L)							
POLYNUCLEAR AROMATIC HYDROCARBONS					0464740006SA	0464740005SA	0464740004SA
Fluorene	-	-			ND	ND	0.11 F
SW8080 (UG/L)							
ORGANOCHLORINE PESTICIDES AND PCBS					0464740006SA	0464740005SA	0464740004SA
Delta bhc (delta hexachlorocyclohexane)	-	-			ND	0.12	ND
Heptachlor epoxide	0.0038	FWQC			ND	1.5 E	ND
SW6010 (UG/L)							
INDUCTIVELY COUPLED PLASMA					0464740006SA	0464740005SA	0464740004SA
Aluminum	87	FWQC	320	124	ND	54.9 F	55.8 F
Barium	-	-	58	2.8	4.0 F	5.8 F	4.9 F
Calcium	-	-	489000	70800	104000 J	125000 J	113000 J
Iron	1000	FWQC/FWQS	280	1280	1510 J	6380 J	3290 J
Potassium	-	-	480000	9200	7190	7190	6880
Magnesium	-	-	1414000	80000	31500	31700	28800
Manganese	-	-	40.9	70	32	47.3	43
Sodium	-	-	12970000	560000	216000 J	212000 J	190000
SW7470 (UG/L)							
MERCURY IN LIQUID WASTE					0464740006SA	0464740005SA	0464740004SA
Mercury	0.012	FWQC/FWQS	-	-	0.059 F	0.081 F	ND

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
FWQC - Federal Water Quality Criteria
FWQS - Florida Water Quality Standards
(-) - No criterion value assigned
BLS - Below land surface
E - Exceeded calibration range of instrument
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

TABLE

Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Phase IV - Analytical Data Summary for Surface Water Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1): Banana River	Background (1): Freshwater	Background (1): Open Ocean	LOCATION:	1381SW05	1381SW06	1381SW07	1381SW08
						SAMPLE DEPTH:	surface	surface	surface	surface
						SAMPLE DATE:	3/7/96	3/7/96	3/7/96	3/14/96
SW8260 (UG/L)										
VOLATILE ORGANIC COMPOUNDS BY GC/MS							0477300004SA	0477300005SA	0477300006SA	0478410004SA
Bromodichloromethane	-	-					2.1 J	1.6 J	0.91 F	ND
Dibromochloromethane	-	-					1.6 J	1.2 J	0.67 F	ND
Total 1,2-Dichloroethene	-	-					ND	ND	ND	4.5
Chloroform	289	FWQC					8.3	7.5	5.1	ND
Vinyl Chloride	-	-					ND	ND	ND	6.9 J
SW8270 (UG/L)										
GC/MS FOR SEMIVOLATILE ORGANICS							0477300004SA	0477300005SA	0477300006SA	0478410004SA
							ND	ND	ND	ND
SW8310 (UG/L)										
POLYNUCLEAR AROMATIC HYDROCARBONS							0477300004SA	0477300005SA	0477300006SA	0478410004SA
Acenaphthene	17	FWQC					0.93 F	ND	ND	ND
Fluoranthene	39.8	FWQC					0.083 F	ND	ND	ND
							ND	ND	ND	ND
SW8080 (UG/L)										
ORGANOCHLORINE PESTICIDES AND PCBS							0477300004SA	0477300005SA	0477300006SA	0478410004SA
Alpha bhc (alpha hexachlorocyclohexane)	500	FWQC					ND	ND	ND	0.033 F
Delta bhc (delta hexachlorocyclohexane)	-	-					0.14	0.32	ND	ND
Alpha endosulfan	0.056	FWQC/FWQS					ND	0.018 F	ND	ND
SW6010 (UG/L)										
INDUCTIVELY COUPLED PLASMA							0477300004SA	0477300005SA	0477300006SA	0478410004SA
Aluminum	87	FWQC	320	124	920		84.5 F	ND	19.9 F	21.4 F
Arsenic	50	FWQS	ND	14.4	ND		29.7	ND	5.4 F	ND
Barium	-	-	58	2.8	22		ND	ND	ND	3.2 F
Calcium	-	-	489000	70800	774000		74600 J	47400 J	57000 J	78300 J
Iron	1000	FWQC/FWQS	280	1280	1020		7930 J	673 J	5870 J	218 J
Potassium	-	-	480000	9200	794000		3820 F	3290 F	3380 F	3750 F
Magnesium	-	-	1414000	80000	2500000		12900	11900	12400	8280
Manganese	-	-	40.9	70	62		38.3	7.4 F	21.5	28
Sodium	-	-	12970000	560000	23600000		106000	102000	108000	29200
Zinc	58.91	FWQC	12	24	ND		19.1 F	ND	ND	ND

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
FWQC - Federal Water Quality Criteria
FWQS - Florida Water Quality Standards
(-) - No criterion value assigned
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected

Cape Canaveral RFI Phase IV
Surface Water

PARAMETERS	Screening Levels Level	Screening Levels Source	1381SW05	1381SW06	1381SW07
LOCATION:			1381SW05	1381SW06	1381SW07
SAMPLE DEPTH:			surface	surface	surface
SAMPLE DATE:			3/7/96	3/7/96	3/7/96
SW6010 (UG/L)					
INDUCTIVELY COUPLED PLASMA			0477300004SA	0477300005SA	0477300006SA
Aluminum	87		84.5 F	ND	19.9 F
Arsenic	50		29.7	ND	5.4 F
Barium			ND	ND	ND
Calcium			74600 J	47400 J	57000 J
Iron	1000		$\boxed{7930\ J}$	673 J	$\boxed{5870\ J}$
Potassium			3820 F	3290 F	3380 F
Magnesium			12900	11900	12400
Manganese			38.3	7.4 F	21.5
Sodium			106000	102000	108000
Zinc	58.91		19.1 F	ND	ND
SW8080 (UG/L)					
ORGANOCHLORINE PESTICIDES AND PCBS			0477300004SA	0477300005SA	0477300006SA
Alpha bhc (alpha hexachlorocyclohexane)	500		ND	ND	ND
Delta bhc (delta hexachlorocyclohexane)			0.14	0.32	ND
Decachlorobiphenyl			99	96	100
Alpha endosulfan	0.056		ND	0.018 F	ND
2,4,5,6-Tetrachloro-meta-xylene			78	64	68
SW8260 (UG/L)					
VOLATILE ORGANIC COMPOUNDS BY GC/MS			0477300004SA	0477300005SA	0477300006SA
Bromodichloromethane			2.1 J	1.6 J	0.91 FJ
Dibromochloromethane			1.6 J	1.2 J	0.67 FJ
Total 1,2-Dichloroethene			ND	ND	ND
Chloroform	289		8.3	7.5	5.1
Vinyl Chloride			ND	ND	ND
SW8270 (UG/L)					
GC/MS FOR SEMIVOLATILE ORGANICS			0477300004SA	0477300005SA	0477300006SA
			ND	ND	ND
SW8310 (UG/L)					
POLYNUCLEAR AROMATIC HYDROCARBONS			0477300004SA	0477300005SA	0477300006SA
Acenaphthene			0.93 F	ND	ND
Fluoranthene			0.083 F	ND	ND

Cape Canaveral RFI Phase IV
Surface Water

PARAMETERS	Screenin Level	LOCATION: 1381SW08
		SAMPLE DEPTH: surface
		SAMPLE DATE: 3/14/96
SW6010 (UG/L)		
INDUCTIVELY COUPLED PLASMA		0478410004SA
Aluminum	87	21.4 F
Arsenic	50	ND
Barium		3.2 F
Calcium		78300 J
Iron	1000	218 J
Potassium		3750 F
Magnesium		8280
Manganese		28
Sodium		29200
Zinc	58.91	ND
SW8080 (UG/L)		
ORGANOCHLORINE PESTICIDES AND PCBS		0478410004SA
Alpha bhc (alpha hexachlorocyclohexane)	500	0.033 F
Delta bhc (delta hexachlorocyclohexane)		ND
Decachlorobiphenyl		89
Alpha endosulfan	0.056	ND
2,4,5,6-Tetrachloro-meta-xylene		74
SW8260 (UG/L)		
VOLATILE ORGANIC COMPOUNDS BY GC/MS		0478410004SA
Bromodichloromethane		ND
Dibromochloromethane		ND
Total 1,2-Dichloroethene		4.5
Chloroform	289	ND
Vinyl Chloride		6.9 J
SW8270 (UG/L)		
GC/MS FOR SEMIVOLATILE ORGANICS		0478410004SA
		ND
SW8310 (UG/L)		
POLYNUCLEAR AROMATIC HYDROCARBONS		0478410004SA
Acenaphthene		ND
Fluoranthene		ND

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Sediment Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION:	1381SE02	1381SE03	1381SE04	1381SER01
			SAMPLE DEPTH (feet BLS):	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
			SAMPLE DATE:	12/17/95	12/17/95	12/17/95	12/17/95
							Dup of SE04/0-1
D2216 (PERCENT)							
PERCENT SOLID				0464780006SA	0464780005SA	0464780004SA	0464780007SA
Moisture, percent	-	-		17	18	16	15
SW8260 (MG/KG)							
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0464780006SA	0464780005SA	0464780004SA	0464780007SA
Acetone	-	-		REJ	REJ	REJ	0.0050 F
Total 1,2-Dichloroethene	-	-		ND	0.032	ND	ND
Methylene chloride	-	-		0.0022 F	0.0022 F	0.0030 F	0.0028 F
Chloroform	-	-		ND	ND	ND	0.0066
Vinyl Chloride	-	-		ND	0.0042 F	0.0096 F	ND
SW8270 (MG/KG)							
GC/MS FOR SEMIVOLATILE ORGANICS				0464780006SA	0464780005SA	0464780004SA	0464780007SA
Bis(2-Ethylhexyl) phthalate	-	-		ND	ND	ND	0.16 F
SW8080 (MG/KG)							
ORGANOCHLORINE PESTICIDES AND PCBS				0464780006SA	0464780005SA	0464780004SA	0464780007SA
Alpha bhc (alpha hexachlorocyclohexane)	-	-		ND	0.00092 F	ND	ND
SW6010 (MG/KG)							
INDUCTIVELY COUPLED PLASMA				0464780006SA	0464780005SA	0464780004SA	0464780007SA
Aluminum				197 J	171 J	266 J	221 J
Arsenic	8	EPA/FQAG		1.6	2.1	1.0 F	1.7
Barium	-	-		3.6 J	3.4 J	6.1 J	3.1 J
Calcium	-	-		111000 J	98200 J	148000 J	110000 J
Chromium, total	33	EPA/FQAG		1.7	1.2	1.1 F	1.3
Iron	-	-		1510 J	1800 J	1830 J	1480 J
Potassium	-	-		37.8 F	ND	ND	35.4 F
Magnesium	-	-		743	609	1410 J	608 J
Manganese	-	-		19.4 J	16.6 J	26.7 J	12.8 J
Sodium	-	-		1060	915	1350	1100
Lead	21	EPA/FQAG		0.9	1.8	1.1	1.1
Vanadium	-	-		2.2	2.1	2.7	2
SW7471 (MG/KG)							
MERCURY IN SOLID OR SEMISOLID WASTE				0464780006SA	0464780005SA	0464780004SA	0464780007SA
Mercury	0.1	EPA/FQAG		0.052 F	0.039 F	0.038 F	0.044 F

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
EPA - US Environmental Protection Agency Region IV Sediment Screening Values
FQAG - Florida Quality Assessment Guidelines
(-) - No criterion value assigned
BLS - Below land surface
E - Exceeded calibration range of instrument
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Sediment Samples

PARAMETERS		LOCATION:	1381SE02	1381SE03	1381SE04	1381SER01
		SAMPLE DEPTH (feet BLS):	0.00 -1.00	0.00 -1.00	0.00 -1.00	0.00 -1.00
		SAMPLE DATE:	12/17/95	12/17/95	12/17/95	12/17/95
Screening Level						
Level	Source					Dup of SE04/0-1

REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

TABLE
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Phase IV - Analytical Data Summary for Sediment Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION:	1381SE05	1381SE06	1381SE07	1381SER01	1381SE08
			SAMPLE DEPTH (feet BLS):	0.00 -1.00	0.00 -1.00	0.00 -1.00	0.00 -1.00	0.00 -1.00
			SAMPLE DATE:	3/7/96	3/7/96	3/7/96	3/7/96	3/14/96
							Dup of SE07	
D2216 (PERCENT)								
PERCENT SOLID				0477310002SA	0477310003SA	0477310005SA	0477310004SA	0478440001SA
Moisture, percent				**20**	**24**	**14**	**16**	**43**
SW8260 (MG/KG)								
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0477310002SA	0477310003SA	0477310005SA	0477310004SA	0478440001SA
Acetone				**0.012 F**	**0.0076 F**	**0.0077 F**	**0.017 J**	**0.0091 F**
Toluene				ND	ND	**0.0015 F**	ND	**0.0027 F**
Total 1,2-Dichloroethene				ND	ND	ND	ND	**0.029**
Methylene chloride				**0.0031 F**	**0.0022 F**	**0.0022 F**	**0.0018 F**	**0.0023 F**
Vinyl Chloride				ND	ND	ND	ND	**0.0054 F**
SW8270 (MG/KG)								
GC/MS FOR SEMIVOLATILE ORGANICS				0477310002SA	0477310003SA	0477310005SA	0477310004SA	0478440001SA
				ND	ND	ND	ND	ND
SW8080 (MG/KG)								
ORGANOCHLORINE PESTICIDES AND PCBS				0477310002SA	0477310003SA	0477310005SA	0477310004SA	0478440001SA
Delta bhc (delta hexachlorocyclohexane)				**0.041**	**0.02**	ND	ND	ND
Gamma bhc (lindane)				ND	ND	ND	**0.0010 F**	ND
PCB-1260 (AROCHLOR 1260)				ND	ND	ND	ND	**0.10 J**

TABLE
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Phase IV - Analytical Data Summary for Sediment Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1): Banana River	Background (1): Freshwater	Background (1): Open Ocean	LOCATION: 1381SE05	1381SE06	1381SE07	1381SER01	1381SE08
SAMPLE DEPTH (feet BLS):						0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00	0.00 - 1.00
SAMPLE DATE:						3/7/96	3/7/96	3/7/96	3/7/96	3/14/96
									Dup of SE07	
SW6010 (MG/KG)										
INDUCTIVELY COUPLED PLASMA						0477310002SA	0477310003SA	0477310005SA	0477310004SA	0478440001SA
Silver	0.5		NA	NA	NA	$\boxed{\text{1.0 F}}$	$\boxed{\text{0.87 F}}$	ND	$\boxed{\text{1.2}}$	ND
Aluminum			549.4	649	644	213	212	176	179	278 J
Arsenic	8		1.1	4.2	2.4	5.6	ND	2.4	1.9	ND
Barium			4.3	6.7	4	4.3 J	6.3 J	3.1 J	3.4 J	2.4
Calcium			21880	376000	73930	184000	231000	80600	84000	42200
Chromium, total	33		3.18	5.5	5.9	ND	ND	0.36 F	ND	ND
Copper	28		1.14	ND	0.57	3.1 F	2.6 F	0.46 F	0.64 F	0.86 F
Iron			923	4430	2480	1500	1880	1220	1140	2020
Potassium			318	ND	271.7	ND	ND	31.4 F	37.3 F	ND
Magnesium			1580	2175	2207	1200	645	601	583	313
Manganese			8.9	39.6	33.6	38.0 J	23.8 J	13.6 J	13.4 J	11.3 J
Sodium			5970	3700	6700	1550	2260	861	849	ND
Lead	21		1.47	1.95	1.77	0.69 F	0.99	0.78	0.69	3.4
Vanadium			2.63	6.1	3.7	2.9	2.1 F	1.7	1.9	2.4
Zinc	68		ND	13	ND	ND	ND	ND	ND	5.9

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
EPA - US Environmental Protection Agency Region IV Sediment Screening Values
FQAG - Florida Quality Assessment Guidelines
TBC - To be considered
(-) - No criterion value assigned
BLS - Below land surface
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected

SITE: 1381 - Ordnance Support Facility

Hit Table (Post Validation)
Cape Canaveral RFI Phase IV
Sediments

PARAMETERS	LOCATION: / SAMPLE DEPTH: / SAMPLE DATE:	1381SE05	1381SE06	1381SE07	1381SE08	1381SER01
	SAMPLE DEPTH:	0.00 -1.00	0.00 -1.00	0.00 -1.00	0.00 -1.00	0.00 -1.00
	SAMPLE DATE:	3/7/96	3/7/96	3/7/96	3/14/96	3/7/96
	Screening Levels Mg/Kg					
D2216 (PERCENT)						
PERCENT SOLID		0477310002SA	0477310003SA	0477310005SA	0478440001SA	0477310004SA
Moisture, percent		**20**	**24**	**14**	**43**	**16**
SW6010 (MG/KG)						
INDUCTIVELY COUPLED PLASMA		0477310002SA	0477310003SA	0477310005SA	0478440001SA	0477310004SA
Silver	0.5	**1.0 F**	**0.87 F**	ND	ND	**1.2**
Aluminum		**213**	**212**	**176**	**278 J**	**179**
Arsenic	8	**5.6**	ND	**2.4**	ND	**1.9**
Barium		**4.3 J**	**6.3 J**	**3.1 J**	**2.4**	**3.4 J**
Calcium		**184000**	**231000**	**80600**	**42200**	**84000**
Chromium, total	33	ND	ND	**0.36 FJ**	ND	ND
Copper	28	**3.1 FJ**	**2.6 FJ**	**0.46 FJ**	**0.86 F**	**0.64 FJ**
Iron		**1500**	**1880**	**1220**	**2020**	**1140**
Potassium		ND	ND	**31.4 F**	ND	**37.3 F**
Magnesium		**1200**	**645**	**601**	**313**	**583**
Manganese		**38.0 J**	**23.8 J**	**13.6 J**	**11.3 J**	**13.4 J**
Sodium		**1550**	**2260**	**861**	ND	**849**
Lead	21	**0.69 F**	**0.99**	**0.78**	**3.4**	**0.69**
Vanadium		**2.9**	**2.1 F**	**1.7**	**2.4**	**1.9**
Zinc	68	ND	ND	ND	**5.9**	ND
SW8080 (MG/KG)						
ORGANOCHLORINE PESTICIDES AND PCBS		0477310002SA	0477310003SA	0477310005SA	0478440001SA	0477310004SA
Delta bhc (delta hexachlorocyclohexane)		**0.041**	**0.02**	ND	ND	ND
Gamma bhc (lindane)		ND	ND	ND	ND	**0.0010 F**
Decachlorobiphenyl		**158**	**123**	**100**	**97**	**103**
PCB-1260 (AROCHLOR 1260)		ND	ND	ND	**0.10 J**	ND
SW8260 (MG/KG)						
VOLATILE ORGANIC COMPOUNDS BY GC/MS		0477310002SA	0477310003SA	0477310005SA	0478440001SA	0477310004SA
Acetone		**0.012 FJ**	**0.0076 FJ**	**0.0077 FJ**	**0.0091 F**	**0.017 J**
Toluene		ND	ND	**0.0015 F**	**0.0027 F**	ND
Total 1,2-Dichloroethene		ND	ND	ND	**0.029**	ND
Methylene chloride		**0.0031 F**	**0.0022 F**	**0.0022 F**	**0.0023 F**	**0.0018 F**

Cape Canaveral RFI Phase IV

Sediments

PARAMETERS	LOCATION:	1381SE05	1381SE06	1381SE07	1381SE08	1381SER01
	SAMPLE DEPTH:	0.00 -1.00	0.00 -1.00	0.00 -1.00	0.00 -1.00	0.00 -1.00
	SAMPLE DATE:	3/7/96	3/7/96	3/7/96	3/14/96	3/7/96
	Screening Levels Mg/Kg					
Vinyl Chloride		ND	ND	ND	**0.0054 F**	ND
SW8270 (MG/KG) GC/MS FOR SEMIVOLATILE ORGANICS		0477310002SA	0477310003SA	0477310005SA	0478440001SA	0477310004SA
		ND	ND	ND	ND	ND

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1)	1381SBA03	1381SBA03	1381SBA04	1381SBA04	1381SBA05	1381SBA05	1381SBA06
SAMPLE DEPTH (feet BLS):				0.00 -1.00	3.00 -4.00	0.00 -1.00	3.00 -4.00	0.00 -1.00	3.00 -4.00	0.00 -1.00
SAMPLE DATE:				12/19/95	12/19/95	12/19/95	12/19/95	12/19/95	12/19/95	12/19/95
D2216 (PERCENT)										
PERCENT SOLID				0465000007SA	0465000008SA	0465000003SA	0465000004SA	0465000001SA	0465000002SA	0464980004SA
Moisture, percent	-	-		**4.7**	**5.9**	**5.7**	**6.2**	**4.5**	**4.5**	**8.3**
SW8260 (MG/KG)										
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0465000007SA	0465000008SA	0465000003SA	0465000004SA	0465000001SA	0465000002SA	0464980004SA
Toluene	0.2	FDEP		ND	ND	ND	ND	ND	ND	**0.0022 F**
Methylene chloride	0.01	FDEP/EPA		ND	ND	ND	ND	ND	ND	**0.0039 F**
Tetrachloroethylene (PCE)	0.03	FDEP		**0.0013 F**	ND	ND	ND	ND	ND	**0.0039 F**
Chloroform	0.02	FDEP		ND	ND	ND	ND	ND	ND	REJ
SW8270 (MG/KG)										
GC/MS FOR SEMIVOLATILE ORGANICS				0465000007SA	0465000008SA	0465000003SA	0465000004SA	0465000001SA	0465000002SA	0464980004SA
Benzo(a)anthracene	0.7	EPA		ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	0.1	FDEP		ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1.4	FDEP		ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	14	FDEP		ND	ND	ND	ND	ND	ND	ND
Chrysene	1	EPA		ND	ND	ND	ND	ND	ND	ND
Fluoranthene	68	EPA		ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	1.4	FDEP		ND	ND	ND	ND	ND	ND	ND
2-Methylphenol (o-cresol)	1.1	FDEP		ND	ND	ND	ND	ND	ND	**0.13 F**
Phenanthrene	2.8	FDEP		ND	ND	ND	ND	ND	ND	ND
Pyrene	56	EPA		ND	ND	ND	ND	ND	ND	ND
SW8080 (MG/KG)										
ORGANOCHLORINE PESTICIDES AND PCBS				0465000007SA	0465000008SA	NA	NA	0465000001SA	0465000002SA	NA
Aldrin	0.005	EPA		ND	ND			ND	ND	
Gamma-chlordane	0.8	FDEP		ND	ND			ND	ND	
PCB-1260 (AROCHLOR 1260)	0.9	FDEP		**0.027 F**	ND			ND	ND	
SW6010 (MG/KG)										
INDUCTIVELY COUPLED PLASMA				0465000007SA	0465000008SA	0465000003SA	0465000004SA	0465000001SA	0465000002SA	0464980004SA
Silver	990	FDEP	NA	ND	ND	ND	**1.7 F**	ND	ND	ND
Aluminum	75000	FDEP	339.8	**483 J**	**258 J**	**342 J**	**280 J**	**322 J**	**288 J**	**501 J**
Arsenic	0.7	FDEP	1.95	**1.0 F**	**2.9**	**2.5**	**1.4 F**	**2.7**	**2.1**	**1.3**
Barium	32	EPA	3.8	**3**	**3.5**	**2.6**	**6.9**	**3.9**	**5.2**	**36.1**
Calcium	-	-	105946	**14700**	**87400**	**64900**	**225000**	**75900 J**	**168000 J**	**29700 J**
Cadmium	6	EPA	0.8	ND	ND	ND	ND	ND	ND	ND
Cobalt	4700	FDEP	ND	ND	ND	**0.45 F**	ND	ND	**0.99 F**	ND
Chromium, total	19	EPA	2.76	**2.7**	**2.2**	**2.6**	ND	**2.7**	**1.6 F**	**75**
Copper	2900	FDEP	ND	**1.7 F**	ND	ND	ND	ND	ND	**5.3**

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION: / SAMPLE DEPTH (feet BLS): / SAMPLE DATE:	1381SBA03 0.00 -1.00 12/19/95	1381SBA03 3.00 -4.00 12/19/95	1381SBA04 0.00 -1.00 12/19/95	1381SBA04 3.00 -4.00 12/19/95	1381SBA05 0.00 -1.00 12/19/95	1381SBA05 3.00 -4.00 12/19/95	1381SBA06 0.00 -1.00 12/19/95
Iron	-	-	1368	1790	2000	1750	2790	2010 J	1980 J	2300 J
Potassium	-	-	ND	30.0 F	ND	ND	ND	ND	ND	42.1 F
Magnesium	-	-	336.58	225 J	624 J	197 J	1040 J	322 J	867 J	266 J
Manganese	370	FDEP	16.46	7.4	17.3	5.7	49.6	21.5	30.7	12.9
Sodium	-	-	1306	ND	681	534	1870 F	644	1620	167 F
Lead	400	OSWER	4.5	2.2 J	1.1 J	1.1 J	1.7 J	2.3 J	0.84 J	85.7 J
Vanadium	490	FDEP	3	1.4	2.5	4.1	3.9 F	3.7	3.6	2.8
Zinc	23000	FDEP	9.53	3.1 J	ND	ND	ND	ND	ND	75.3
SW7041 (MG/KG)										
ANTIMONY (AA, FURNACE TECHNIQUE)				0465000007SA	0465000008SA	0465000003SA	0465000004SA	0465000001SA	0465000002SA	0464980004SA
Antimony	26	FDEP	8.4	ND	ND	ND	ND	ND	ND	ND
SW7471 (MG/KG)										
MERCURY IN SOLID OR SEMISOLID WASTE				0465000007SA	0465000008SA	0465000003SA	0465000004SA	0465000001SA	0465000002SA	0464980004SA
Mercury	3	EPA	ND	ND	ND	ND	ND	ND	ND	0.059 F
SW7841 (MG/KG)										
THALLIUM (AA, FURNACE TECHNIQUE)				0465000007SA	0465000008SA	0465000003SA	0465000004SA	0465000001SA	0465000002SA	0464980004SA
Thallium	0.4	EPA	ND	ND	ND	ND	ND	ND	ND	ND

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
EPA - US Environmental Protection Agency
FDEP - Florida Department of Environmental Protection Soil Target Level
OSWER - Office of Solid Waste and Emergency Response
EPA - US Environmental Protection Agency Region IV Sediment Screening Values
FQAG - Florida Quality Assessment Guidelines
GWGC - Florida Groundwater Guidance Concentrations
MCL - Maximum Contaminant Level
SDWS - Secondary Drinking Water Standards
FWQC - Federal Water Quaaltiy Criteria
FWQS - Florida Water Quality Standards
(-) - No criterion value assigned
BLS - Below land surface
E - Exceeded calibration range of instrument
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1)	1381SBA06	1381SBA07	1381SBA07	1381SBA08	1381SBA08	1381SBA09	1381SBA09
SAMPLE DEPTH (feet BLS):				3.00 -4.00	0.00 -1.00	3.00 -4.00	0.00 -1.00	3.00 -4.00	0.00 -1.00	3.00 -4.00
SAMPLE DATE:				12/19/95	12/19/95	12/19/95	12/19/95	12/19/95	12/19/95	12/19/95
D2216 (PERCENT)										
PERCENT SOLID				0464980005SA	0464980001SA	0464980003SA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Moisture, percent	-	-		3.6	6.7	5.3	8.1	6.3	9.4	4
SW8260 (MG/KG)										
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0464980005SA	0464980001SA	0464980003SA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Toluene	0.2	FDEP		ND	ND	ND	ND	ND	ND	ND
Methylene chloride	0.01	FDEP/EPA		ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene (PCE)	0.03	FDEP		ND	0.00011 F	ND	ND	ND	ND	ND
Chloroform	0.02	FDEP		ND	0.0024 F	0.0011 F	0.0013 F	ND	ND	ND
SW8270 (MG/KG)										
GC/MS FOR SEMIVOLATILE ORGANICS				0464980005SA	0464980001SA	0464980003SA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Benzo(a)anthracene	0.7	EPA		ND	ND	ND	0.13 F	ND	0.060 F	ND
Benzo(a)pyrene	0.1	FDEP		ND	ND	ND	0.093 F	ND	ND	ND
Benzo(b)fluoranthene	1.4	FDEP		ND	ND	ND	0.19 F	ND	0.068 F	ND
Benzo(g,h,i)perylene	14	FDEP		ND	ND	ND	0.061 F	ND	ND	ND
Chrysene	1	EPA		ND	ND	ND	0.16 F	ND	0.076 F	ND
Fluoranthene	68	EPA		ND	ND	ND	0.28 F	ND	0.19 F	ND
Indeno(1,2,3-c,d)pyrene	1.4	FDEP		ND	ND	ND	0.054 F	ND	ND	ND
2-Methylphenol (o-cresol)	1.1	FDEP		ND	ND	ND	ND	ND	ND	ND
Phenanthrene	2.8	FDEP		ND	ND	ND	0.15 F	ND	0.068 F	ND
Pyrene	56	EPA		ND	ND	ND	0.21 F	ND	0.12 F	ND
SW8080 (MG/KG)										
ORGANOCHLORINE PESTICIDES AND PCBS				NA	NA	NA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Aldrin	0.005	EPA					0.0013 F	ND	ND	0.00044 F
Gamma-chlordane	0.8	FDEP					0.0012 F	ND	ND	ND
PCB-1260 (AROCHLOR 1260)	0.9	FDEP					0.21	0.011 F	0.43	ND
SW6010 (MG/KG)										
INDUCTIVELY COUPLED PLASMA				0464980005SA	0464980001SA	0464980003SA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Silver	990	FDEP	NA	ND	ND	ND	ND	ND	ND	ND
Aluminum	75000	FDEP	339.8	294 J	325 J	273 J	601 J	279 J	1380 J	311 J
Arsenic	0.7	FDEP	1.95	1.4 F	2	0.70 F	1.6 J	1.7 J	0.75 F	3.9 J
Barium	32	EPA	3.8	6.1	3	3.8	4.5	3.3	5.7	4.6
Calcium	-	-	105946	108000 J	51200 J	125000 J	90100 J	95300 J	108000 J	118000 J
Cadmium	6	EPA	0.8	ND	ND	ND	0.26 F	ND	ND	ND
Cobalt	4700	FDEP	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, total	19	EPA	2.76	2.7	2.2	1.6 F	4.9	2	3.9	3.3
Copper	2900	FDEP	ND	ND	ND	ND	3.9	ND	1.3 F	ND

TABLE 3.X

Facility 1381 - Ordnance Support Facility (1381)

Cape Canaveral Air Station, FL

Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level		LOCATION: / SAMPLE DEPTH (feet BLS): / SAMPLE DATE:	1381SBA06 3.00 -4.00 12/19/95	1381SBA07 0.00 -1.00 12/19/95	1381SBA07 3.00 -4.00 12/19/95	1381SBA08 0.00 -1.00 12/19/95	1381SBA08 3.00 -4.00 12/19/95	1381SBA09 0.00 -1.00 12/19/95	1381SBA09 3.00 -4.00 12/19/95
	Level	Source								
Iron	-	-	1368	2010 J	1660 J	1620 J	1740 J	1660 J	1570 J	2750 J
Potassium	-	-	ND	ND	48.5 F	ND	51.2 F	ND	47.3 F	ND
Magnesium	-	-	336.58	550 J	295 J	729 J	568 J	518 J	613 J	507 J
Manganese	370	FDEP	16.46	24.6	12.2	17.3	19	16.6	15.2	17.6
Sodium	-	-	1306	795 F	401 F	896 F	426 F	695	355 F	919 F
Lead	400	OSWER	4.5	1.8 J	1.9 J	1.7 J	27.5 J	2.4 J	9.9 J	0.89 J
Vanadium	490	FDEP	3	3.4	4.1	4.1	3.9	3.3	4.3	3.8
Zinc	23000	FDEP	9.53	3.6 F	ND	ND	33.2 J	4.2	10.7	ND
SW7041 (MG/KG)										
ANTIMONY (AA, FURNACE TECHNIQUE)				0464980005SA	0464980001SA	0464980003SA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Antimony	26	FDEP	8.4	ND	ND	ND	ND	ND	ND	ND
SW7471 (MG/KG)										
MERCURY IN SOLID OR SEMISOLID WASTE				0464980005SA	0464980001SA	0464980003SA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Mercury	3	EPA	ND	0.039 F	0.023 F	ND	0.035 F	0.023 F	ND	0.039 F
SW7841 (MG/KG)										
THALLIUM (AA, FURNACE TECHNIQUE)				0464980005SA	0464980001SA	0464980003SA	0464980010SA	0464980012SA	0464980014SA	0464980015SA
Thallium	0.4	EPA	ND	$\boxed{1.2\ F}$	ND	$\boxed{0.84\ F}$	ND	ND	ND	ND

Notes:

(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)

EPA - US Environmental Protection Agency

FDEP - Florida Department of Environmental Protection Soil Target Level

OSWER - Office of Solid Waste and Emergency Response

EPA - US Environmental Protection Agency Region IV Sediment Screening Values

FQAG - Florida Quality Assessment Guidelines

GWGC - Florida Groundwater Guidance Concentrations

MCL - Maximum Contaminant Level

SDWS - Secondary Drinking Water Standards

FWQC - Federal Water Quaaltiy Criteria

FWQS - Florida Water Quality Standards

(-) - No criterion value assigned

BLS - Below land surface

B - Exceeded calibration range of instrument

F - Estimated value between method detection limit and reporting limit

J - Estimated value above reporting limit

NA - Sample not analyzed for this parameter

ND - Not detected

REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

DRAFT

TABLE 3.X

Facility 1381 - Ordnance Support Facility (1381)

Cape Canaveral Air Station, FL

Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION: / SAMPLE DEPTH (feet BLS): / SAMPLE DATE:	1381SBA10 0.00 - 1.00 12/19/95	1381SBA10 3.00 - 4.00 12/19/95	1381SBA11 0.00 - 1.00 12/19/95	1381SBA11 3.00 - 4.00 12/19/95	1381SBA12 0.00 - 1.00 12/19/95	1381SBA12 3.00 - 4.00 12/19/95	1381SBA13 0.00 - 1.00 12/19/95
D2216 (PERCENT)										
PERCENT SOLID				0465000005SA	0465000006SA	0464980009SA	0465000015SA	0464980016SA	0464980017SA	0464980007SA
Moisture, percent	-	-		7.2	4.8	6.6	4.3	9.2	6.1	7.3
SW8260 (MG/KG)										
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0465000005SA	0465000006SA	0464980009SA	0465000015SA	0464980016SA	0464980017SA	0464980007SA
Toluene	0.2	FDEP		ND	ND	ND	ND	ND	ND	ND
Methylene chloride	0.01	FDEP/EPA		ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene (PCE)	0.03	FDEP		ND	ND	ND	ND	ND	ND	ND
Chloroform	0.02	FDEP		ND	ND	ND	ND	ND	0.0013 F	0.0013 F
SW8270 (MG/KG)										
GC/MS FOR SEMIVOLATILE ORGANICS				0465000005SA	0465000006SA	0464980009SA	0465000015SA	0464980016SA	0464980017SA	0464980007SA
Benzo(a)anthracene	0.7	EPA		ND	ND	0.058 F	ND	ND	ND	ND
Benzo(a)pyrene	0.1	FDEP		ND	ND	0.056 F	ND	ND	ND	ND
Benzo(b)fluoranthene	1.4	FDEP		ND	ND	0.15 F	ND	ND	ND	ND
Benzo(g,h,i)perylene	14	FDEP		ND	ND	0.052 F	ND	ND	ND	0.079 F
Chrysene	1	EPA		ND	ND	0.098 F	ND	ND	ND	ND
Fluoranthene	68	EPA		ND	ND	ND	ND	ND	ND	0.066 F
Indeno(1,2,3-c,d)pyrene	1.4	FDEP		ND	ND	ND	ND	ND	ND	0.13 F
2-Methylphenol (o-cresol)	1.1	FDEP		ND	ND	ND	ND	ND	ND	ND
Phenanthrene	2.8	FDEP		ND	ND	ND	ND	ND	ND	0.10 F
Pyrene	56	EPA		ND	ND	0.092 F	ND	ND	ND	0.099 F
SW8080 (MG/KG)										
ORGANOCHLORINE PESTICIDES AND PCBS				0465000005SA	0465000006SA	NA	NA	NA	NA	NA
Aldrin	0.005	EPA		ND	ND					
Gamma-chlordane	0.8	FDEP		ND	ND					
PCB-1260 (AROCHLOR 1260)	0.9	FDEP		0.12	0.088					
SW6010 (MG/KG)										
INDUCTIVELY COUPLED PLASMA			Background (1)	0465000005SA	0465000006SA	0464980009SA	0465000015SA	0464980016SA	0464980017SA	0464980007SA
Silver	990	FDEP	NA	ND	ND	ND	ND	ND	ND	ND
Aluminum	75000	FDEP	339.8	456 J	326 J	584 J	304 J	332 J	230 J	723 J
Arsenic	0.7	FDEP	1.95	1.3	2.3	1.7 F	1.8	1.2 F	1.7 J	0.86 F
Barium	32	EPA	3.8	4.1	4.5	5.9	4	5.2	2.6	4.7
Calcium	-	-	105946	56700	117000	144000 J	114000	121000 J	71300 J	66400 J
Cadmium	6	EPA	0.8	0.21 F	ND	ND	ND	ND	ND	ND
Cobalt	4700	FDEP	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, total	19	EPA	2.76	3.8	2.0 F	3.1	1.8 F	2.6	1.9	3.3
Copper	2900	FDEP	ND	0.51 F	ND	ND	ND	ND	ND	ND

TABLE 3.X

Facility 1381 - Ordnance Support Facility (1381)

Cape Canaveral Air Station, FL

Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION: / SAMPLE DEPTH (feet BLS): / SAMPLE DATE:	1381SBA10 0.00 -1.00 12/19/95	1381SBA10 3.00 -4.00 12/19/95	1381SBA11 0.00 -1.00 12/19/95	1381SBA11 3.00 -4.00 12/19/95	1381SBA12 0.00 -1.00 12/19/95	1381SBA12 3.00 -4.00 12/19/95	1381SBA13 0.00 -1.00 12/19/95
Iron	-	-	1368	1840	1940	1420 J	1720	2370 J	1220 J	2000 J
Potassium	-	-	ND	32.4 F	ND	ND	ND	ND	ND	42.8 F
Magnesium	-	-	336.58	385 J	602 J	1090 J	432 J	595 J	229 J	324 J
Manganese	370	FDEP	16.46	22.7	20.8	25.9	16.8	24.6	9.9	11.1
Sodium	-	-	1306	479 F	978 F	809 F	960 F	ND	544	406 F
Lead	400	OSWER	4.5	3.9 J	1.9 J	3.4 J	1.1 J	5.7 J	0.90 J	2.8 J
Vanadium	490	FDEP	3	2.7	3.5	4	3.1	3.3	2.7	3.3
Zinc	23000	FDEP	9.53	5.7 J	ND	7.1	ND	9.4	ND	2.4
SW7041 (MG/KG)										
ANTIMONY (AA, FURNACE TECHNIQUE)				0465000005SA	0465000006SA	0464980009SA	0465000015SA	0464980016SA	0464980017SA	0464980007SA
Antimony	26	FDEP	8.4	ND	ND	ND	ND	ND	ND	ND
SW7471 (MG/KG)										
MERCURY IN SOLID OR SEMISOLID WASTE				0465000005SA	0465000006SA	0464980009SA	0465000015SA	0464980016SA	0464980017SA	0464980007SA
Mercury	3	EPA	ND	ND	ND	0.046 F	ND	ND	ND	0.053 F
SW7841 (MG/KG)										
THALLIUM (AA, FURNACE TECHNIQUE)				0465000005SA	0465000006SA	0464980009SA	0465000015SA	0464980016SA	0464980017SA	0464980007SA
Thallium	0.4	EPA	ND	ND	ND	ND	ND	ND	0.85 F	ND

Notes:

(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
EPA - US Environmental Protection Agency
FDEP - Florida Department of Environmental Protection Soil Target Level
OSWER - Office of Solid Waste and Emergency Response
EPA - US Environmental Protection Agency Region IV Sediment Screening Values
FQAG - Florida Quality Assessment Guidelines
GWGC - Florida Groundwater Guidance Concentrations
MCL - Maximum Contaminant Level
SDWS - Secondary Drinking Water Standards
FWQC - Federal Water Quaaltiy Criteria
FWQS - Florida Water Quality Standards
(-) - No criterion value assigned
BLS - Below land surface
E - Exceeded calibration range of instrument
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

DRAFT

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1)	1381SBA13	1381SBA14	1381SBA14	1381SBA15	1381SBA15	1381SBA16
SAMPLE DEPTH (feet BLS):				3.00 -4.00	0.00 -1.00	3.00 -4.00	0.00 -1.00	3.00 -4.00	0.00 -1.00
SAMPLE DATE:				12/19/95	12/19/95	12/19/95	12/19/95	12/19/95	12/19/95
D2216 (PERCENT)									
PERCENT SOLID				0464980008SA	0465000013SA	0465000014SA	0465000009SA	0465000010SA	0465000011SA
Moisture, percent	-	-		**3.8**	**5.1**	**4.8**	**5.4**	**7.7**	**6.5**
SW8260 (MG/KG)									
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0464980008SA	0465000013SA	0465000014SA	0465000009SA	0465000010SA	0465000011SA
Toluene	0.2	FDEP		ND	ND	ND	**0.0012 F**	ND	ND
Methylene chloride	0.01	FDEP/EPA		ND	ND	ND	ND	ND	ND
Tetrachloroethylene (PCE)	0.03	FDEP		ND	ND	ND	**0.0022 F**	ND	**0.0013 F**
Chloroform	0.02	FDEP		**0.0078**	**0.0025 F**	**0.0043 F**	ND	ND	**0.0023 F**
SW8270 (MG/KG)									
GC/MS FOR SEMIVOLATILE ORGANICS				0464980008SA	0465000013SA	0465000014SA	0465000009SA	0465000010SA	0465000011SA
Benzo(a)anthracene	0.7	EPA		ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	0.1	FDEP		ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1.4	FDEP		ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	14	FDEP		ND	ND	ND	ND	ND	**0.079 F**
Chrysene	1	EPA		ND	ND	ND	ND	ND	ND
Fluoranthene	68	EPA		ND	ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	1.4	FDEP		ND	ND	ND	ND	ND	ND
2-Methylphenol (o-cresol)	1.1	FDEP		ND	ND	ND	ND	ND	ND
Phenanthrene	2.8	FDEP		ND	ND	ND	ND	ND	ND
Pyrene	56	EPA		ND	ND	ND	ND	ND	ND
SW8080 (MG/KG)									
ORGANOCHLORINE PESTICIDES AND PCBS				NA	NA	NA	NA	NA	NA
Aldrin	0.005	EPA							
Gamma-chlordane	0.8	FDEP							
PCB-1260 (AROCHLOR 1260)	0.9	FDEP							
SW6010 (MG/KG)									
INDUCTIVELY COUPLED PLASMA				0464980008SA	0465000013SA	0465000014SA	0465000009SA	0465000010SA	0465000011SA
Silver	990	FDEP	NA	ND	ND	ND	ND	ND	**0.70 F**
Aluminum	75000	FDEP	339.8	**297 J**	**448 J**	**270 J**	**287 J**	**274 J**	**503 J**
Arsenic	0.7	FDEP	1.95	**2.6 J**	**1.1**	**2.8**	**0.57 F**	**2.5**	**1.5 F**
Barium	32	EPA	3.8	**3.2**	**1.9**	**3.5**	**1.6**	**6.4**	**5.6**
Calcium	-	-	105946	**98000 J**	**18600**	**104000**	**5730**	**176000**	**137000**
Cadmium	6	EPA	0.8	ND	ND	ND	ND	ND	ND
Cobalt	4700	FDEP	ND	ND	ND	**0.60 F**	ND	ND	ND
Chromium, total	19	EPA	2.76	**2**	**3.3**	**2.3**	**1.9**	**1.2 F**	**2.0 F**
Copper	2900	FDEP	ND	ND	ND	ND	ND	ND	ND

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION: / SAMPLE DEPTH (feet BLS): / SAMPLE DATE:	1381SBA13 3.00 -4.00 12/19/95	1381SBA14 0.00 -1.00 12/19/95	1381SBA14 3.00 -4.00 12/19/95	1381SBA15 0.00 -1.00 12/19/95	1381SBA15 3.00 -4.00 12/19/95	1381SBA16 0.00 -1.00 12/19/95
Iron	-	-	1368	1830 J	1670	2050	835	2180	1260
Potassium	-	-	ND	ND	34.2 F	ND	ND	ND	ND
Magnesium	-	-	336.58	503 J	186 J	409 J	93.5 J	912 J	810 J
Manganese	370	FDEP	16.46	14.2	7.7	21.3	4.4	21	21.2
Sodium	-	-	1306	714	113 F	731	ND	1350	1230
Lead	400	OSWER	4.5	0.69 J	1.4 J	0.91 J	1.1 J	0.81 J	2.1 J
Vanadium	490	FDEP	3	3.4	2.2	3.5	1.0 F	3.2	2.5
Zinc	23000	FDEP	9.53	ND	2.1 J	ND	2.8 J	ND	ND
SW7041 (MG/KG)									
ANTIMONY (AA, FURNACE TECHNIQUE)				0464980008SA	0465000013SA	0465000014SA	0465000009SA	0465000010SA	0465000011SA
Antimony	26	FDEP	8.4	ND	ND	0.60 F	ND	ND	ND
SW7471 (MG/KG)									
MERCURY IN SOLID OR SEMISOLID WASTE				0464980008SA	0465000013SA	0465000014SA	0465000009SA	0465000010SA	0465000011SA
Mercury	3	EPA	ND	0.039 F	ND	ND	ND	ND	ND
SW7841 (MG/KG)									
THALLIUM (AA, FURNACE TECHNIQUE)				0464980008SA	0465000013SA	0465000014SA	0465000009SA	0465000010SA	0465000011SA
Thallium	0.4	EPA	ND	ND	ND	ND	ND	ND	ND

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
EPA - US Environmental Protection Agency
FDEP - Florida Department of Environmental Protection Soil Target Level
OSWER - Office of Solid Waste and Emergency Response
EPA - US Environmental Protection Agency Region IV Sediment Screening Values
FQAG - Florida Quality Assessment Guidelines
GWGC - Florida Groundwater Guidance Concentrations
MCL - Maximum Contaminant Level
SDWS - Secondary Drinking Water Standards
FWQC - Federal Water Quaaltiy Criteria
FWQS - Florida Water Quality Standards
(-) - No criterion value assigned
BLS - Below land surface
E - Exceeded calibration range of instrument
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

TABLE 3.X
Facility 1381 - Ordnance Support Facility (1381)
Cape Canaveral Air Station, FL
Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1)	LOCATION: 1381SBA16	1381SBR01	1381SBR02	1381SBR03	1381SBR04
			SAMPLE DEPTH (feet BLS):	3.00 -4.00	0.00 -1.00	3.00 -4.00	3.00 -4.00	0.00 -1.00
			SAMPLE DATE:	12/19/95	12/19/95	12/19/95	12/19/95	12/19/95
D2216 (PERCENT)								
PERCENT SOLID				0465000012SA	0464980011SA	0464980013SA	0464980006SA	0464980002SA
Moisture, percent	-	-		**4.1**	**8.6**	**4.6**	**3.4**	**6.3**
SW8260 (MG/KG)								
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0465000012SA	0464980011SA	0464980013SA	0464980006SA	0464980002SA
Toluene	0.2	FDEP		ND	ND	ND	ND	ND
Methylene chloride	0.01	FDEP/EPA		ND	ND	ND	ND	ND
Tetrachloroethylene (PCE)	0.03	FDEP		**0.0014 F**	ND	ND	ND	**0.0018 F**
Chloroform	0.02	FDEP		ND	ND	ND	**0.0010 F**	ND
SW8270 (MG/KG)								
GC/MS FOR SEMIVOLATILE ORGANICS				0465000012SA	0464980011SA	0464980013SA	0464980006SA	0464980002SA
Benzo(a)anthracene	0.7	EPA		ND	ND	ND	ND	ND
Benzo(a)pyrene	0.1	FDEP		ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1.4	FDEP		ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	14	FDEP		ND	ND	ND	ND	ND
Chrysene	1	EPA		ND	ND	ND	ND	ND
Fluoranthene	68	EPA		ND	ND	ND	ND	ND
Indeno(1,2,3-c,d)pyrene	1.4	FDEP		ND	ND	ND	ND	ND
2-Methylphenol (o-cresol)	1.1	FDEP		ND	ND	ND	ND	ND
Phenanthrene	2.8	FDEP		ND	ND	ND	ND	ND
Pyrene	56	EPA		ND	**0.056 F**	ND	ND	ND
SW8080 (MG/KG)								
ORGANOCHLORINE PESTICIDES AND PCBS				NA	0464980011SA	0464980013SA	NA	NA
Aldrin	0.005	EPA			**0.0022 F**	ND		
Gamma-chlordane	0.8	FDEP			ND	ND		
PCB-1260 (AROCHLOR 1260)	0.9	FDEP			**0.31**	**0.011 F**		
SW6010 (MG/KG)								
INDUCTIVELY COUPLED PLASMA				0465000012SA	0464980011SA	0464980013SA	0464980006SA	0464980002SA
Silver	990	FDEP	NA	ND	ND	ND	ND	ND
Aluminum	75000	FDEP	339.8	**390 J**	**675 J**	**246 J**	**338 J**	**384 J**
Arsenic	0.7	FDEP	1.95	$\boxed{2.2}$	$\boxed{1.5 J}$	$\boxed{1.4 J}$	$\boxed{2.3}$	$\boxed{1.5}$
Barium	32	EPA	3.8	**3.9**	**4.9**	**3.2**	**5.7**	**4.5**
Calcium	-	-	105946	**102000**	**83200 J**	**91700 J**	**110000 J**	**80300 J**
Cadmium	6	EPA	0.8	ND	**0.33 F**	ND	ND	ND
Cobalt	4700	FDEP	ND	ND	ND	ND	ND	ND
Chromium, total	19	EPA	2.76	**2.4**	**4.4**	**1.5**	**2.9**	**2.5**
Copper	2900	FDEP	ND	ND	**4.5**	ND	ND	ND

TABLE 3.X

Facility 1381 - Ordnance Support Facility (1381)

Cape Canaveral Air Station, FL

Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	LOCATION: / SAMPLE DEPTH (feet BLS): / SAMPLE DATE:	1381SBA16 3.00 -4.00 12/19/95	1381SBR01 0.00 -1.00 12/19/95	1381SBR02 3.00 -4.00 12/19/95	1381SBR03 3.00 -4.00 12/19/95	1381SBR04 0.00 -1.00 12/19/95
Iron	-	-	1368	1870	1760 J	1290 J	2300 J	1680 J
Potassium	-	-	ND	ND	56.5 F	ND	ND	40.6 F
Magnesium	-	-	336.58	600 J	540 J	512 J	528 J	388 J
Manganese	370	FDEP	16.46	21	17.8	15.8	25.8	13.8
Sodium	-	-	1306	803	449 F	604	895 F	631
Lead	400	OSWER	4.5	1.4 J	27.8 J	1.9 J	3.4 J	1.2 J
Vanadium	490	FDEP	3	3.2	4	2.6	3.9	4.8
Zinc	23000	FDEP	9.53	1.9 F	57.3 J	4.4	3.4 F	ND
SW7041 (MG/KG)								
ANTIMONY (AA, FURNACE TECHNIQUE)				0465000012SA	0464980011SA	0464980013SA	0464980006SA	0464980002SA
Antimony	26	FDEP	8.4	ND	ND	ND	ND	ND
SW7471 (MG/KG)								
MERCURY IN SOLID OR SEMISOLID WASTE				0465000012SA	0464980011SA	0464980013SA	0464980006SA	0464980002SA
Mercury	3	EPA	ND	ND	0.035 F	ND	ND	ND
SW7841 (MG/KG)								
THALLIUM (AA, FURNACE TECHNIQUE)				0465000012SA	0464980011SA	0464980013SA	0464980006SA	0464980002SA
Thallium	0.4	EPA	ND	ND	ND	ND	ND	ND

Notes:

(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)

EPA - US Environmental Protection Agency

FDEP - Florida Department of Environmental Protection Soil Target Level

OSWER - Office of Solid Waste and Emergency Response

EPA - US Environmental Protection Agency Region IV Sediment Screening Values

FQAG - Florida Quality Assessment Guidelines

GWGC - Florida Groundwater Guidance Concentrations

MCL - Maximum Contaminant Level

SDWS - Secondary Drinking Water Standards

FWQC - Federal Water Quaaltiy Criteria

FWQS - Florida Water Quality Standards

(-) - No criterion value assigned

BLS - Below land surface

E - Exceeded calibration range of instrument

F - Estimated value between method detection limit and reporting limit

J - Estimated value above reporting limit

NA - Sample not analyzed for this parameter

ND - Not detected

REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

Table 3.X
Facility 1381 - Ordnance Support Facility
Cape Canaveral Air Station, FL
Phase IV - Analytical Data Summary for Soil Samples

PARAMETERS	Screening Level: Level	Screening Level: Source	Background (1)	LOCATION: 1381SBA17	1381SBA17	1381SBR01
			SAMPLE DEPTH (feet BLS):	0.00 -1.00	3.00 -4.00	3.00 -4.00
			SAMPLE DATE:	3/15/96	3/15/96	3/15/96
						Dup of SBA17
D2216 (PERCENT)						
PERCENT SOLID				0478610004SA	0478610005SA	0478610006SA
Moisture, percent				**11**	**12**	**13**
SW8260 (MG/KG)						
VOLATILE ORGANIC COMPOUNDS BY GC/MS				0478610004SA	0478610005SA	0478610006SA
Methylene chloride	0.01	FDEP/EPA		**0.0016 F**	**0.0018 F**	**ND**
SW8270 (MG/KG)						
GC/MS FOR SEMIVOLATILE ORGANICS				0478610004SA	0478610005SA	0478610006SA
				ND	ND	ND
SW8080 (MG/KG)						
ORGANOCHLORINE PESTICIDES AND PCBS				0478610004SA	0478610005SA	0478610006SA
4,4-DDT	0.5	FDEP		**0.0028 F**	ND	ND
Dieldrin	0.001	EPA		**0.0015 F**	ND	ND
Alpha endosulfan	-	-		**0.0012 F**	ND	ND
PCB-1260 (AROCHLOR 1260)	0.9	FDEP		**0.09**	**0.034 F**	**0.027 F**
SW6010 (MG/KG)						
INDUCTIVELY COUPLED PLASMA				0478610004SA	0478610005SA	0478610006SA
Aluminum	75000	FDEP	339.8	**580 J**	**365 J**	**319 J**
Arsenic	0.7	FDEP	1.95	**1.9 F**	**4**	**3.6**
Barium	32	EPA	3.8	**6.2**	**5.8**	**5.1**
Calcium	-	-	105946	**158000**	**122000**	**149000**
Chromium, total	19	EPA	2.76	**3.3**	**2.5**	**1.8 F**
Copper	2900	FDEP	ND	**2.2 F**	**1.2 F**	ND
Iron	-	-	1368	**2860**	**3260**	**2860**
Magnesium	-	-	336.58	**316**	**850**	**849**
Manganese	370	FDEP	16.46	**8.3**	**21.1**	**20.5**
Sodium	-	-	1306	**1570**	ND	**1320**
Lead	400	OSWER	4.5	**4**	**1.7**	**2.3**
Vanadium	490	FDEP	3	**3.8**	**3.9**	**3**
Zinc	23000	FDEP	9.53	**3.8 F**	ND	ND

Notes:
(1) - Background level data originally reported in RI/FS Volume 2B Baseline Data Development Program (BDDP, November 1995, O'Brien & Gere Engineers, Inc.)
EPA - US Environmental Protection Agency
FDEP - Florida Department of Environmental Protection Soil Target Level
OSWER - Office of Solid Waste and Emergency Response
(-) - No criterion value assigned
BLS - Below land surface
F - Estimated value between method detection limit and reporting limit
J - Estimated value above reporting limit
NA - Sample not analyzed for this parameter
ND - Not detected
REJ - Data unusable for all purposes. Presence or absence of the analyte has not been verified.

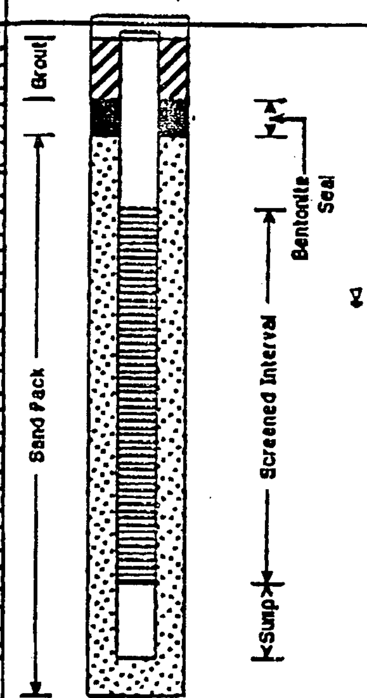
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Page 1 of 1

Project I.D. AT508 SI #2	Client 45th Space Wing
Installation Cape Canaveral AFS	Date Installed 30-Nov-93
Site Fac. 1381 - Ordnance Support Facility	Date Grouted 02-Dec-93
Boring/Well I.D. 1381-MWS01	Casing Material 2" PVC
Geologist/Engineer Federico Artioli	Screen Material 2" PVC 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) 0 to -5
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -5 to -15
Date Started 30-Nov-93	Sump Installed? Yes
Date Completed 30-Nov-93	Pad Installed? Yes
Driller Groundwater Protection, Inc.	Well Depth (ft) 17
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 7.34
Depth Drilled (ft) 18	Date Measured 07-Dec-93
Ground Elevation (ft) 8.393	TOC Elevation (ft) 8.251
X-Coordinate 797423.170	Water Level MSL (ft) 0.91
Y-Coordinate 1504383.270	

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0	X	N/A	-	0	0	SAND, fine, tr silt, little to some shell frag, loose, very pale brown (10YR8/3), dry, T=23C.	SDFN	SP	
5	X	5,9, 13,15	85	0	0	SAND, fine to med, tr silt, some shell frag, very firm, pale yellow (2.5Y8/4), dry, T=24C.	SDMD	SP	
	X	7,9, 18,35	70	0	0	SAND, fine to med, tr silt, some shell frag, very firm, light olive brown (2.5Y5/4), wet, T=24C.	SDMD		
10									
15	X	9,12, 12,28	65	30-22 =8	2.8	SAND, fine to med, tr silt, some shell frag, very firm, light olive brown (2.5Y5/4), wet, T=24C. At 15.7-15.9 SAND, fine to med, and shell frag, light olive brown (2.5Y5/4). At 15.9-17 SAND, fine to med, tr silt, some shell frag, greenish gray (Gley 5G6/1).	SDMD		
						Boring terminated at 18'.			
20									

WELL DIAGRAM



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To Todd Herrington	From Anthony Giacoia
Co. Parsons ES / Denver	Co. Parsons ES / Orlando
Dept.	Phone #
Fax #	Fax #

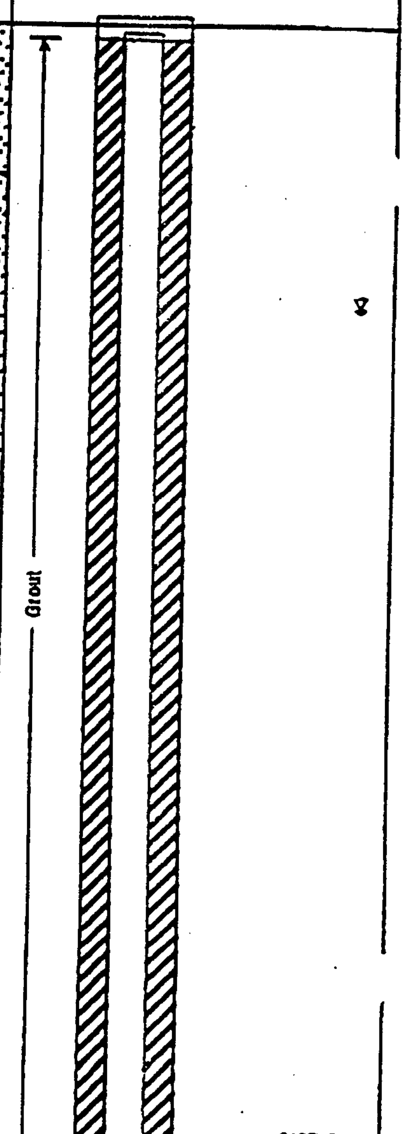
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. AT509 SI #2
Installation Cape Canaveral AFS
Site Fac. 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD01
Geologist/Engineer Federico Artioli
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 30-Nov-93
Date Completed 30-Nov-93
Driller Groundwater Protection, Inc.
Borehole Diameter (in) 8.25
Depth Drilled (ft) 51
Ground Elevation (ft) 8.393
X-Coordinate 787428.617
Y-Coordinate 1504379.287

Client 45th Space Wing
Date Installed 30-Nov-93
Date Grouted 30-Nov-93
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 0 to -38
Screened Interval (ft) -38 to -48
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 50
Depth to Water BTOC (ft) 7.38
Date Measured 07-Dec-93
TOC Elevation (ft) 8.220
Water Level MSL (ft) 0.84

Depth (feet)	Sample	Blows/6 in	% Rec.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	Lithologic Description	Lithcode	ASTMcode	Graphic Log
0	X	N/A	-	0	0	SAND, fine, tr silt, little to some shell frag, loose, grayish brown (10YR5/2), dry, T=22C.	SDFN	SP	
5	X	6,11, 12,23	80	0	0	SAND, fine to med, tr silt, little to some shell frag, very firm, pale yellow (2.5Y8/2), dry, T=24C.	SDMD	SP	
10	X	6,8, 21,25	60	0	0	SAND, fine to med, tr silt, little to some shell frag, very firm, light yellowish brown (2.5Y6/4), wet, T=24C.	SDMD		
15	X	4,10, 14,30	65	0	0	SAND, fine to med, tr silt, some shell frag, very firm, greenish gray (Gley 5G6/1), wet, T=24C.	SDMD		
	X	31,14, 17,24	75	50-45 =5	0	SAND, fine, tr silt, tr shell frag, dense, greenish gray (Gley 5G6/1), wet, T=24C.	SDFN	SP	
	X	7,5, 8,11	75	80-50 =30	1000	SAND, fine, tr silt, tr shell frag, firm, greenish gray (Gley 5G6/1), wet, T=24C.	SDFN		

WELL DIAGRAM



CAPEWELL

ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

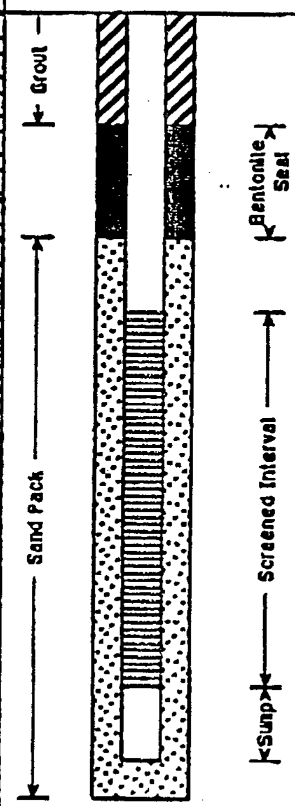
Installation Cape Canaveral AFS
Site Fac. 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MW001
Geologist/Engineer Federico Artioli

Project I.D. AT509 SI #2
Client 45th Space Wing
Date Installed 30-Nov-93

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30	X	5,10, 13,18	75	85-36 =49	500	SAND, fine, tr silt, tr shell frag, very firm, greenish gray (Gley 5G6/1), wet, T=24C.	SDFN	SP
35	X	8,5, 4,4	100	65-46 =19	400	SAND, fine, little to some silt, little shell frag, little clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	SM
	X	1,2, 2,4	100	80-34 =46	1000	SAND, fine, little to some silt, little shell frag, little clay, very loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
40	X	4,2, 2,2	80	58-46 =12	700	SAND, fine to med, little to some silt, little to some shell frag, little clay, very loose, greenish gray (Gley 5G5/1), wet, T=24C. At 39-39.1 and 39.4-39.5 CLAY, greenish gray (Gley 5G5/1), moist.	SDSL CLAY	SM CL
	X	3,3, 4,9	100	60-53 =7	550	SAND, fine to med, some silt, some shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	SM
	X	3,4, 5,8	100	70-60 =10	1000	SAND, fine to med, some silt, and shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
45	X	4,4, 5,5	100	60-57 =3	100	SAND, fine to med, some silt, and shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet T=24C.	SDSL	
	X	4,6, 7,8	85	32-36 =0	180	SAND, fine to med, some silt, some shell frag, some clay, firm, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
50	X	10,2, 3,3	100	42-35 =7	1000	SAND, fine to med, some silt, some shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
	X	3,4, 5,3	100	36-42 =0	400	CLAY, tr sand, tr organics, tr shell frag, stiff, dark greenish gray (Gley 5G4/1), moist to dry, T=24C.	CLAY	CL
55						Boring terminated at 51'.		

GRAPHIC LOG

WELL DIAGRAM

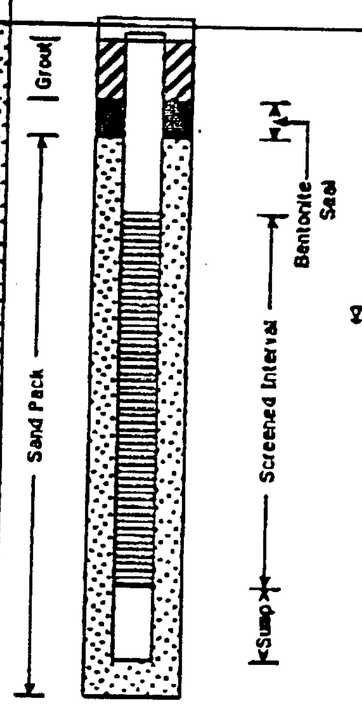


ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. AT509 SI #2	Client 45th Space Wing
Installation Cape Canaveral AFS	Date Installed 01-Dec-93
Site Fac. 1381 - Ordnance Support Facility	Date Grouted 02-Dec-93
Boring/Well I.D. 1381-MWS02	Casing Material 2" PVC
Geologist/Engineer Federico Artioli	Screen Material 2" PVC 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) 0 to -5
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -5 to -15
Date Started 01-Dec-93	Sump Installed? Yes
Date Completed 01-Dec-93	Pad Installed? Yes
Driller Groundwater Protection, Inc.	Well Depth (ft) 17
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 7.44
Depth Drilled (ft) 18	Date Measured 07-Dec-93
Ground Elevation (ft) 8.639	TOC Elevation (ft) 8.347
X-Coordinate 797491.974	Water Level MSL (ft) 0.91
Y-Coordinate 1504368.771	

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0	X	N/A	-	0	0	SAND, fine to medium, trace of silt, some shell fragments, loose, very pale brown (10YR7/4), dry, T=23C.	SDMO	SP	
5	X	7,10, 15,21	80	0.1	0	SAND, fine to medium, trace of silt, some shell fragments, very firm, yellow (10YR7/8), dry, T=24C.	SDMO		
10	X	2,4, 12,21	65	0.2	0.1	SAND, fine to medium, trace of silt, and shell fragments, firm, dark yellow brown (10YR4/6), wet, T=24C.	SDMD		
15	X	5,14, 13,33	80	68-18 50	43	SAND, fine to medium, trace to little silt, some shell fragments, very firm, pale olive (5Y6/4), wet, T=24C. At 16.1-18.4 SAND, fine to medium, little silt, and shell fragments, pale olive (5Y6/4).	SDFN	SP	
						Boring terminated at 18'.			
20									
25									

WELL DIAGRAM

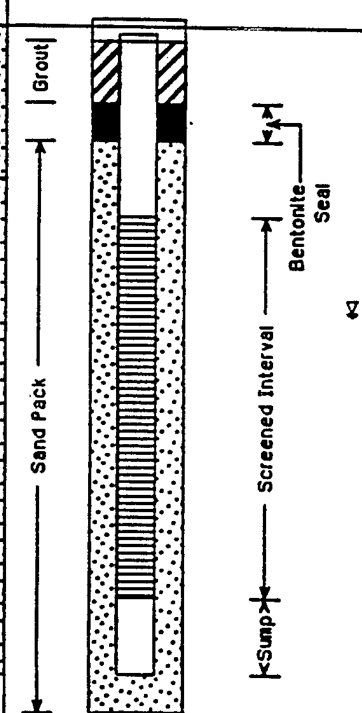


ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. AT509 SI #2	Client 45th Space Wing
Installation Cape Canaveral AFS	Date Installed 30-Nov-93
Site Fac. 1381 - Ordnance Support Facility	Date Grouted 02-Dec-93
Boring/Well I.D. 1381-MWS01	Casing Material 2" PVC
Geologist/Engineer Federico Artioli	Screen Material 2" PVC 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) 0 to -5
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -5 to -15
Date Started 30-Nov-93	Sump Installed? Yes
Date Completed 30-Nov-93	Pad Installed? Yes
Driller Groundwater Protection, Inc.	Well Depth (ft) 17
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 7.34
Depth Drilled (ft) 18	Date Measured 07-Dec-93
Ground Elevation (ft) 8.393	TOC Elevation (ft) 8.251
X-Coordinate 797423.170	Water Level MSL (ft) 0.91
Y-Coordinate 1504383.270	

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		N/A	-	0	0	SAND, fine, tr silt, little to some shell frag, loose, very pale brown (10YR8/3), dry, T=23C.	SDFN	SP	
5		5,9, 13,15	85	0	0	SAND, fine to med, tr silt, some shell frag, very firm, pale yellow (2.5Y8/4), dry, T=24C.	SDMD	SP	
10		7,9, 18,35	70	0	0	SAND, fine to med, tr silt, some shell frag, very firm, light olive brown (2.5Y5/4), wet, T=24C.	SDMD		
15		9,12, 12,26	95	30-22 =8	2.8	SAND, fine to med, tr silt, some shell frag, very firm, light olive brown (2.5Y5/4), wet, T=24C. At 15.7-15.9 SAND, fine to med, and shell frag, light olive brown (2.5Y5/4). At 15.9-17 SAND, fine to med, tr silt, some shell frag, greenish gray (Gley 5G6/1).	SDMD		
20						Boring terminated at 18'.			
25									

WELL DIAGRAM



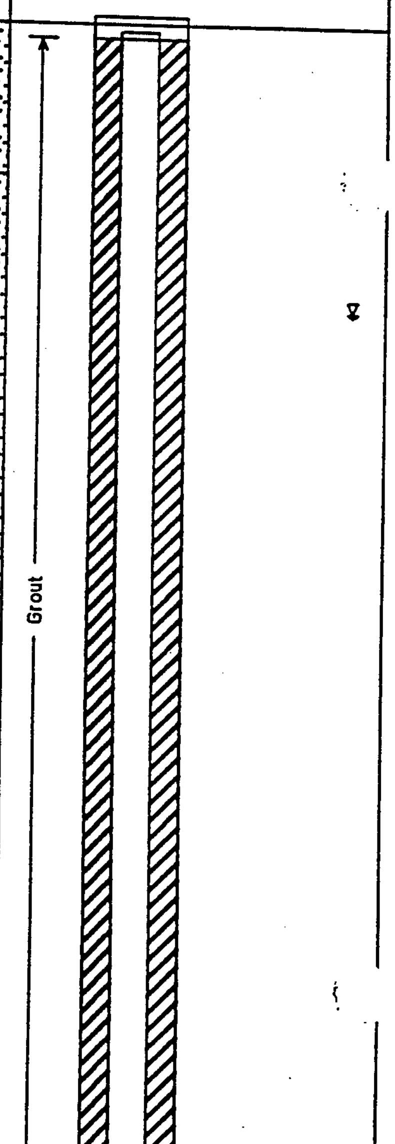
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. AT509 SI #2
Installation Cape Canaveral AFS
Site Fac. 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD01
Geologist/Engineer Federico Artioli
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 30-Nov-93
Date Completed 30-Nov-93
Driller Groundwater Protection, Inc.
Borehole Diameter (in) 8.25
Depth Drilled (ft) 51
Ground Elevation (ft) 8.393
X-Coordinate 797428.617
Y-Coordinate 1504379.287

Client 45th Space Wing
Date Installed 30-Nov-93
Date Grouted 30-Nov-93
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 0 to -38
Screened Interval (ft) -38 to -48
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 50
Depth to Water BTOC (ft) 7.38
Date Measured 07-Dec-93
TOC Elevation (ft) 8.220
Water Level MSL (ft) 0.84

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0	X	N/A	-	0	0	SAND, fine, tr silt, little to some shell frag, loose, grayish brown (10YR5/2), dry, T=22C.	SDFN	SP	
5	X	6,11, 12,23	80	0	0	SAND, fine to med, tr silt, little to some shell frag, very firm, pale yellow (2.5Y8/2), dry, T=24C.	SDMD	SP	
10	X	6,8, 21,25	60	0	0	SAND, fine to med, tr silt, little to some shell frag, very firm,light yellowish brown (2.5Y6/4), wet, T=24C.	SDMD		
15	X	4,10, 14,30	65	0	0	SAND, fine to med, tr silt, some shell frag, very firm, greenish gray (Gley 5G6/1), wet, T=24C.	SDMD		
20	X	31,14, 17,24	75	50-45 =5	0	SAND, fine, tr silt, tr shell frag, dense, greenish gray (Gley 5G6/1), wet, T=24C.	SDFN	SP	
25	X	7,5, 8,11	75	80-50 =30	1000	SAND, fine, tr silt, tr shell frag, firm, greenish gray (Gley 5G6/1), wet, T=24C.	SDFN		

WELL DIAGRAM



ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

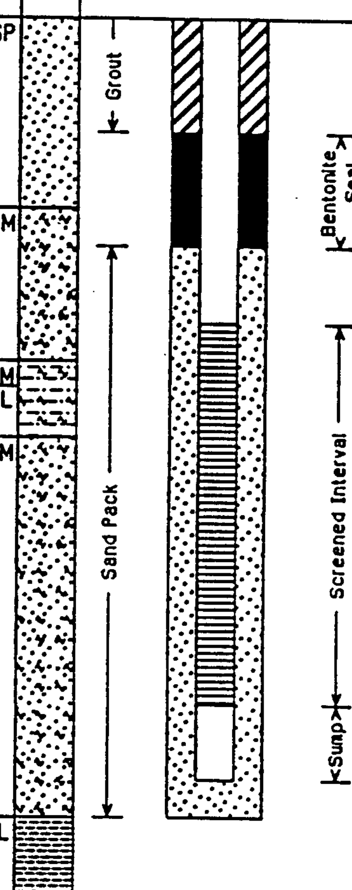
Installation Cape Canaveral AFS
Site Fac. 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD01
Geologist/Engineer Federico Artioli

Project I.D. AT509 SI #2
Client 45th Space Wing
Date Installed 30-Nov-93

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30	X	5,10, 13,18	75	85-36 =49	500	SAND, fine, tr silt, tr shell frag, very firm, greenish gray (Gley 5G6/1), wet, T=24C.	SDFN	SP
35	X	8,5, 4,4	100	65-46 =19	400	SAND, fine, little to some silt, little shell frag, little clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	SM
	X	1,2, 2,4	100	80-34 =46	1000	SAND, fine, little to some silt, little shell frag, little clay, very loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
40	X	4,2, 2,2	80	58-46 =12	700	SAND, fine to med, little to some silt, little to some shell frag, little clay, very loose, greenish gray (Gley 5G5/1), wet, T=24C. At 39-39.1 and 39.4-39.5 CLAY, greenish gray (Gley 5G5/1), moist.	SDSL CLAY	SM CL
	X	3,3, 4,9	100	60-53 =7	550		SDSL	SM
	X	3,4, 5,8	100	70-60 =10	1000	SAND, fine to med, some silt, some shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
45	X	4,4, 5,5	100	60-57 =3	100	SAND, fine to med, some silt, and shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
	X	4,6, 7,8	85	32-38 =0	180	SAND, fine to med, some silt, and shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet T=24C.	SDSL	
50	X	10,2, 3,3	100	42-35 =7	1000	SAND, fine to med, some silt, some shell frag, some clay, firm, greenish gray (Gley 5G5/1), wet, T=24C.	SDSL	
	X	3,4, 5,3	100	36-42 =0	400	SAND, fine to med, some silt, some shell frag, some clay, loose, greenish gray (Gley 5G5/1), wet, T=24C.	CLAY	CL
55						CLAY, tr sand, tr organics, tr shell frag, stiff, dark greenish gray (Gley 5G4/1), moist to dry, T=24C.		
						Boring terminated at 51'.		
60								
65								

GRAPHIC LOG

WELL DIAGRAM



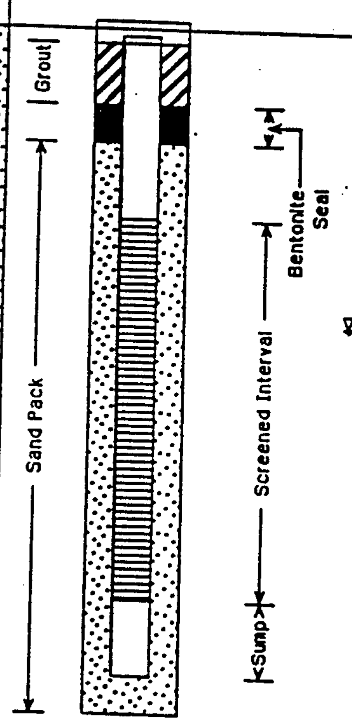
ENGINEERING - SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. AT509 SI #2
Installation Cape Canaveral AFS
Site Fac. 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS02
Geologist/Engineer Federico Artioli
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 01-Dec-93
Date Completed 01-Dec-93
Driller Groundwater Protection, Inc.
Borehole Diameter (in) 10.25
Depth Drilled (ft) 18
Ground Elevation (ft) 8.639
X-Coordinate 797491.974
Y-Coordinate 1504368.771

Client 45th Space Wing
Date Installed 01-Dec-93
Date Grouted 02-Dec-93
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 0 to -5
Screened Interval (ft) -5 to -15
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 17
Depth to Water BTOC (ft) 7.44
Date Measured 07-Dec-93
TOC Elevation (ft) 8.347
Water Level MSL (ft) 0.91

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0	X	N/A	-	0	0	SAND, fine to medium, trace of silt, some shell fragments, loose, very pale brown (10YR7/4), dry, T=23C.	SDMD	SP	
5	X	7,10, 15,21	80	0.1	0	SAND, fine to medium, trace of silt, some shell fragments, very firm, yellow (10YR7/8), dry, T=24C.	SDMD		
10	X	2,4, 12,21	65	0.2	0.1	SAND, fine to medium, trace of silt, and shell fragments, firm, dark yellow brown (10YR4/6), wet, T=24C.	SDMD		
15	X	5,14, 13,33	80	68-18 50	43	SAND, fine to medium, trace to little silt, some shell fragments, very firm, pale olive (5Y6/4), wet, T=24C. At 16.1-16.4 SAND, fine to medium, little silt, and shell fragments, pale olive (5Y6/4).	SDFN	SP	
						Boring terminated at 18'.			
25									

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576	Client 45th Space Wing
Installation Cape Canaveral AS	Date Installed 22-Sep-95
Site Facility 1381 - Ordnance Support Facility	Date Grouted 22-Sep-95
Boring/Well I.D. 1381-MWD02	Casing Material 2" PVC
Geologist/Engineer Federico Artioli	Screen Material 2" PVC 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) -0.25 to -46
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -46 to -51
Date Started 25-Sep-95	Sump Installed? No
Date Completed 25-Sep-95	Pad Installed? Yes
Driller EDS	Well Depth (ft) 51
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 4.61
Depth Drilled (ft) 53.0	Date Measured 04-Apr-96
Ground Elevation (ft) 9.30	TOC Elevation (ft) 9.15
X-Coordinate 797489.60	Water Level MSL (ft) 4.54
Y-Coordinate 1504365.49	

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
	X	N/A	-	0.1	0.1	SAND, fine to med, trace silt, ltl shell, loose, pale yellow (2.5Y7/4), dry.	SDFN	SP	
5	X	15,15, 14,11	88	0	0	SAND, fine to med, tarce silt, ltl shell, v. firm, pale yellow (2.5Y7/4), moist to wet.	SDFN		
10	X	5,7, 12,17	100	42	1.2	SAND, fine to coarse, trace silt, ltl shell, firm, olive (5Y5/4), wet.	SDFN		
15	X	12,23, 40,35	58	227	8.8	SAND, fine, trace silt, trace shell, v. dense, olive (5Y5/4), wet.	SDFN		
20	X	12,18, 24,26	58	206	56.2	SAND, fine, trace silt, trace shell, dense, bluish gray (5B6/1), wet.	SDFN		
25	X	5,5, 14,10	42	13.2	0.1	SAND, fine, trace silt, trace shell, firm, bluish gray (5B5/1), wet.	SDFN		

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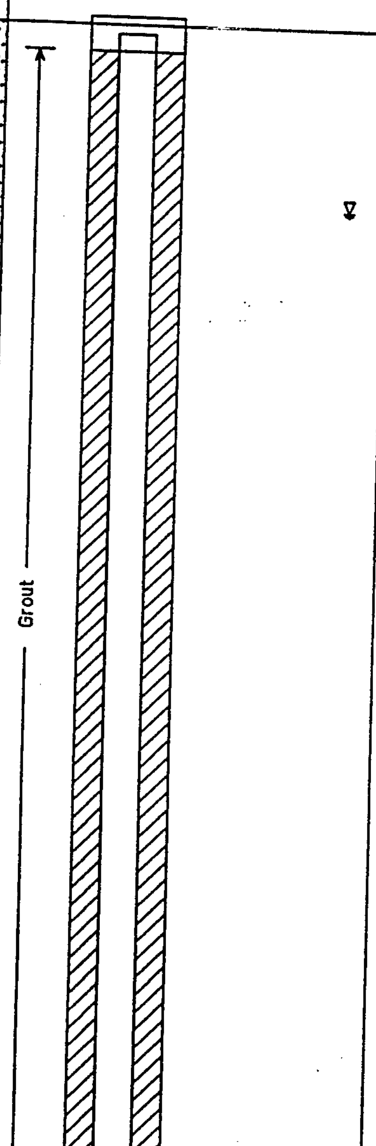
WELL DIAGRAM



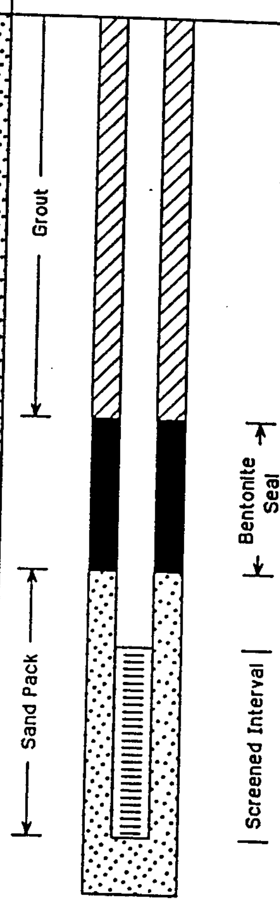
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD02
Geologist/Engineer Federico Artioli

Project I.D. CCAS RFI - 727576
Client 45th Space Wing
Date Installed 22-Sep-95

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
30	X	4,4, 5,8	67	25.1	10.6	SAND, fine, trace silt, trace shell, loose, bluish gray (5B5/1), wet.		SP	
	X	3,3, 4,5	100	39.5	71.2	SAND, fine, ltl silt, trace shell, trace clay, loose, bluish gray (5B5/1), wet.	SDFN		
	X	2,2, 2,9	100	40.1	46.5	SAND, fine, ltl silt, trace shell, ltl clay, v. loose, drk greenish gray (5BG4/1), wet.	SDFN		
	X	7,3, 6,4	100	51.4	20.9	SAND, fine to med, trace silt, trace shell, loose, greenish gray (5G5/1), wet.	SDFN		
	X	6,8, 6,9	100	30.7	13	SAND, fine to med, trace silt, ltl to and shell, firm, dark greenish gray (5BG4/1), wet.	SDFN		
	X	6,6, 9,10	100	40.1	14.2	SAND, fine, trace silt, trace clay, ltl shell, firm, greenish gray, (5BG5/1), wet.	SDFN		
45	X	12,12, 16,20	67	0.2	15.2	SAND, coarse to fine, trace silt, and shell, v. firm, drk greenish gray (5BG4/1), wet.	SDCR	SW	
	X	12,20, 21,22	100	5.4	23.7	SAND, coarse to fine, trace to ltl silt, some shell, trace clay, dense, drk greenish gray (5BG4/1), wet.	SDCR		
50	X	2,2, 2,2	100	0.1	1.5	SAND, coarse to fine, ltl silt, and shell, ltl clay, v. loose, (5BG4/1), wet; at 50.3 to 51.0 CLAY.	SDCR/ CLAY		
	X	2,2, 3,3	71	0.3	1.3	CLAY, trace organics, firm, drk greenish gray (5G4/1), moist	CLAY	CL	
55						Boring terminated at 53 ft.			
60									
65									

WELL DIAGRAM



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PARSONS ENGINEERING SCIENCE

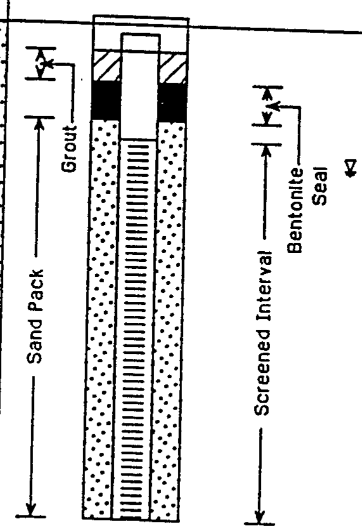
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS03
Geologist/Engineer Federico Artioli
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 22-Sep-95
Date Completed 22-Sep-95
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 16.0
Ground Elevation (ft) 8.24
X-Coordinate 797436.66
Y-Coordinate 1504588.46

Client 45th Space Wing
Date Installed 22-Sep-95
Date Grouted 22-Sep-95
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) -0.25 to -3.0
Screened Interval (ft) -3.0 to -13.0
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft) 3.82
Date Measured 04-Apr-96
TOC Elevation (ft) 8.38
Water Level MSL (ft) 4.56

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
	X	N/A	-	0.6	0	SAND, fine grained, trace silt, little shell ragments, loose, light gray, (2.5 Y 7/2), dry.	SDFN	SP	
5	X	10,10 8,12	88	1.5	0	SAND, fine to medium grained, trace silt, little to some shell fragments, firm, light yellowish brown (2.5 Y 6/3), wet.	SDFN		
10	X	6,8, 8,10	100	8.7	0	SAND, fine to medium grained, trace silt, little shell fragments, firm, light yellowish brown (2.5 Y 6/3), wet; at 11.0 to 12.0 SAND, coarse to fine grained, little silt, and shell fragments, firm greenish gray (5BG 5/1), wet.	SDFN/ SDCR	SW	
15	X	6,6, 12,10	100	1.5	0	SAND, coarse to fine grained, trace silt, little to some shell fragments, firm, bluish gray (5B 5/1), wet.	SDMD		
20									
25									

WELL DIAGRAM



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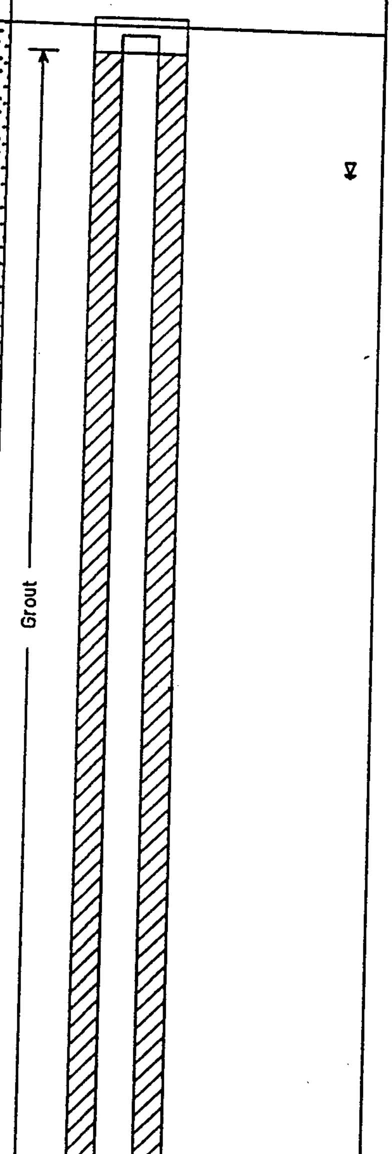
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD03
Geologist/Engineer Federico Artioli
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 22-Sep-95
Date Completed 22-Sep-95
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 53.0
Ground Elevation (ft) 8.24
X-Coordinate 797440.25
Y-Coordinate 1504588.38

Client 45th Space Wing
Date Installed 22-Sep-95
Date Grouted 22-Sep-95
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) -0.25 to -46.5
Screened Interval (ft) -46.5 to -51.5
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 51.5
Depth to Water BTOC (ft) 3.75
Date Measured 04-Apr-96
TOC Elevation (ft) 8.30
Water Level MSL (ft) 4.55

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
	X	N/A	-	0	0	SAND, fine, trace silt, ltl shell, loose, lgt gray (2.5Y7/2), dry.	SDFN	SP	
5	X	12,10, 8,12	71	0	0	SAND, fine to med, trace silt, trace shell, firm, brownish yellow (10YR6/8), wet; at 5.5 to 6.0 SAND, fine to med, trace silt, some shell, firm, pale yellow (2.5Y7/3), wet.	SDFN		
10	X	2,4, 5,10	100	7.4	0	SAND, fine to med, trace silt, ltl shell, loose, lgt yellowish brown (2.5Y6/3), wet; at 11.1 to 12.0 SAND, coarse to fine, ltl silt, some to and shell, firm, greenish gray (5BG5/1), wet.	SDFN/ SDCR	SW	
15	X	5,10, 18,20	100	1.7	1.5	SAND, coarse to fine, trace silt, ltl to some shell, firm, greenish gray (5G5/1), wet.	SDCR		
0	X	3,5, 12,15	100	0.1	0	SAND, fine, trace silt, trace shell, firm, greenish gray (5G5/1), wet.	SDFN	SP	
5	X	6,5, 10,10	83	0	0	SAND, fine, trace silt, trace shell, ltl clay, loose, drk greenish gray (5G4/1), wet.	SDFN		

WELL DIAGRAM



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PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

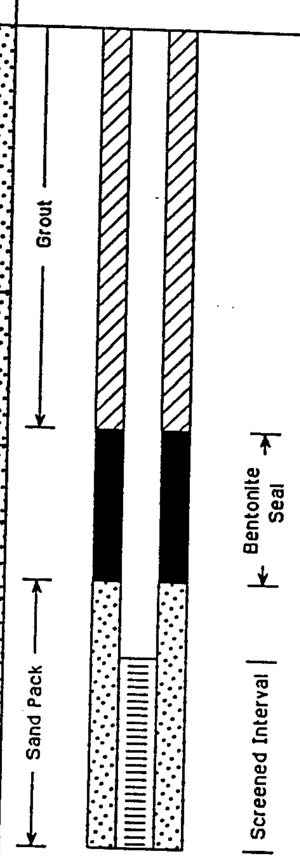
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD03
Geologist/Engineer Federico Artioli

Project I.D. CCAS RFI - 727576
Client 45th Space Wing
Date Installed 22-Sep-95

BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
4,4, 5,6	71	0	0	SAND, fine, trace to ltl silt, ltl shell, trace clay, loose, drk greenish gray (5G4/1), wet.		SP
1,2, 3,1	88	0.2	0	SAND, fine, trace silt, trace shell, ltl clay, loose, drk greenish gray (5G4/1), wet.	SDFN	
2,2, 7,7	100	0.1	0	SAND, fine, ltl silt, trace shell, ltl to some clay, loose, (5G4/1), wet.	SDCL	SC
2,3, 7,5	83	0.3	0	SAND, fine, ltl silt, trace shell, ltl to some clay, loose, drk greenish gray (5G4/1),wet.	SDCL	
7,10, 14,10	88	0.3	0	SAND, fine, ltl silt, ltl to and shell, trace to ltl clay, v. firm, (5G4/1), wet.	SDCL	SP
2,2, 6,6	83	0.9	0	SAND, fine, trace silt, and shell, some to and clay, loose, drk greenish gray, (5G4/1), wet.	SDCL	SC
10,8, 10,14	100	1.0	0	SAND, coarse to fine, trace silt, and shell, trace clay, firm, (5G4/1), wet.	SDCR	SW
6,9, 6,7	100	1.1	0	SAND, coarse to fine, trace silt, some to and shell, ltl clay, firm, drk greenish gray (5G4/1), wet.	SDCR	
6,4, 4,4	100	0.3	0	SAND, coarse to fine, trace silt, and shell, ltl clay loose, (5G4/1), wet.	SDCR	
2,3, 3,5	79	0.9	0	CLAY, firm, ltl organics, drk greenish gray (5BG4/1), dry to moist	CLAY	CL

Boring terminated at 53 ft.

WELL DIAGRAM



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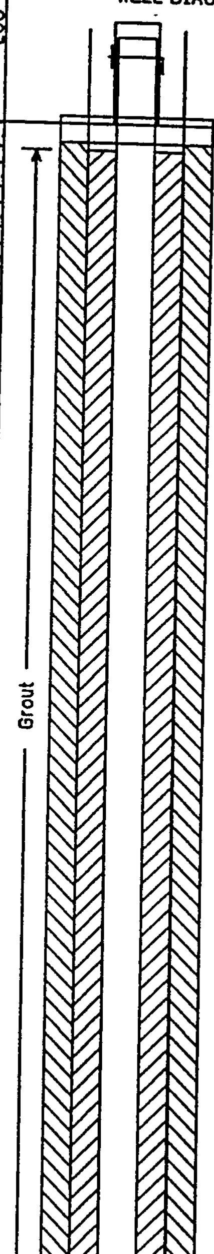
PARSONS ENGINEERING SCIENCE

SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD04
Geologist/Engineer Federico Artioli
Drilling Method Mud Rotary
Sampling Method 2 1/4" Split Spoon
Date Started 04-Dec-95
Date Completed 08-Dec-95
Driller EDS
Borehole Diameter (in) 6.00/10.00
Depth Drilled (ft) 80.0
Ground Elevation (ft) 9.52
X-Coordinate 797418.48
Y-Coordinate 1504305.43

Client 45th Space Wing
Date Installed 08-Dec-95
Date Grouted 08-Dec-95
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) -0.25 to -72.5
Screened Interval (ft) -72.5 to -77.5
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 77.5
Depth to Water BTOC (ft) 2.05
Date Measured 04-Apr-96
TOC Elevation (ft) 12.23
Water Level MSL (ft) 10.18

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG	WELL DIAGRAM
0						Slit spoons collected from 42 feet to 80 feet bls due to previously defined lithology.		SP		



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PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWD04
Geologist/Engineer Federico Artioli

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 08-Dec-95

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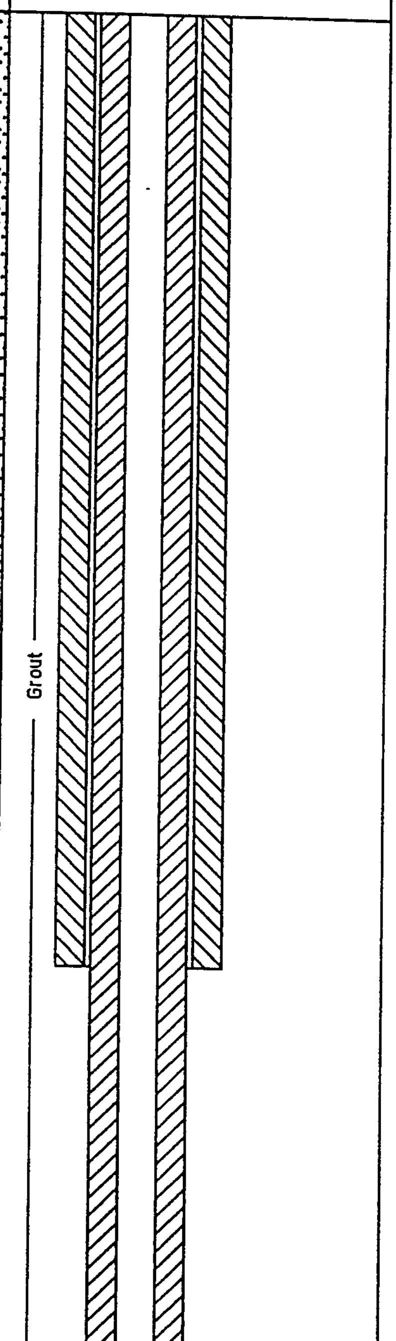
DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
30								SP	
35									
40									
	X	5,4 5,4	30	0.2	0	SAND, fine, trace silt, trace clay, and shell, loose, drk greenish gray (5GY4/1), wet.	SDFN		
45	X	4,5, 8,6	40	0.4	0	SAND, coarse to fine, trace silt, and shell, ltl clay, firm, (5GY4/1).	SDCR	SW	
	X	8,7, 9,7	30	1.1	0	SAND, coarse to fine, ltl silt, trace clay, and shell, firm, drk greenish gray (5GY4/1), wet.	SDCR		
	X	6,9, 6,5	70	0.9	0	SAND, coarse to fine, ltl silt, ltl clay, and shell, firm, (5GY4/1), wet.	SDCR		
50	X	7,8, 9,10	100	1.1	0	SAND, coarse to fine, ltl silt, ltl clay, and shell, firm (5GY4/1), wet; at 51.7 ft CLAY, stiff, (5G4/1), moist.	SDCR/ CLAY	CL	
	X	N/A	0	N/A	0	No recovery.			
	X	5,4, 4,5	100	1.1	0	CLAY, trace organics, firm, dark greenish gray (5G4/1), moist.	CLAY		
	X	0,0, 0,0	42	0.8	0	CLAY, ltl shell, v. loose, grey (5G4/1), moist.	CLAY		
	X	6,5 5,4	75	0.4	0	SAND, fine to med, ltl silt, and shell, firm, lgt greenish grey (5GY7/1), wet.	SDFN	SP	
	X	11,8 6,5	100	1.5	0	SAND, fine to med, ltl silt, some shell, firm (5GY7/1), wet.	SDFN		

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

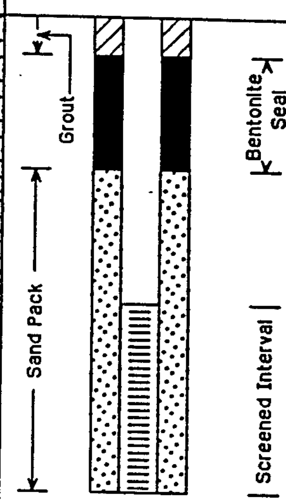
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD04
Geologist/Engineer Federico Artioli

Project I.D. CCAS RFI - 727576
Client 45th Space Wing
Date Installed 08-Dec-95

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
65		7,7 9,8	29	2.0	0	SAND, fine, trace silt, ltl shell, firm, greenish gray (5G5/1), wet.	SDFN	SP
		7,6, 8,6	33	4.8	0	SAND, fine, trace silt, ltl shell, firm, (5G5/1), wet.	SDFN	
		5,4, 4,4	25	9.6	0	SAND, fine, trace silt, ltl shell, loose, (5G5/1), wet.	SDFN	
		3,3, 4,4	17	8.7	0	SAND, fine, trace silt, ltl shell, ltl to some clay, loose, (5G5/1), wet.	SDFN	
		28,21 14,14	100	0.4	0	CLAY, ltl shell, hard, (5G5/1), moist. At 75.3 ft, SAND, med to fine, trace silt, some shell, v. firm, (5G5/1), wet.	CLAY/ SDMD	CL / SP
		16,20 30,30	100	0.2	0	SAND, coarse to fine, trace silt, some shell, dense, (5G5/1), wet.	SDCR/ SDMD	
		28,29 39,27	100	0.6	0	CLAY, trace shell, hard, (5G5/1), wet.	CLAY/ SDCR	CL / SW
80						Boring terminated at 80.0'		

GRAPHIC LOG

WELL DIAGRAM



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PARSONS ENGINEERING SCIENCE

SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS05
Geologist/Engineer Federico Artioli
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 25-Jan-96
Date Completed 25-Jan-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 13.0
Ground Elevation (ft) 7.68
X-Coordinate 797005.30
Y-Coordinate 1504447.00

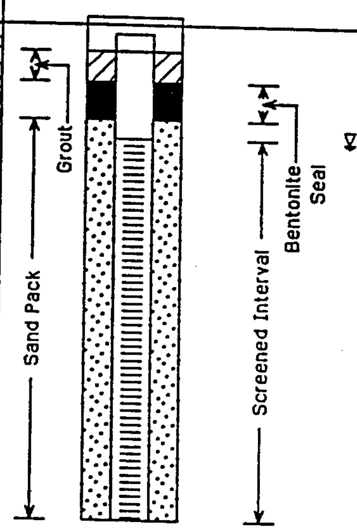
Client 45th Space Wing
Date Installed 22-Sep-95 ?
Date Grouted 22-Sep-95 ?
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) -0.25 to -3.0
Screened Interval (ft) -3.0 to -13.0
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft) 6.55
Date Measured 04-Apr-96
TOC Elevation (ft) 11.18
Water Level MSL (ft) 4.63

(feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
0	X	N/A	-	0.6	0	SAND, fine, trace silt, ltl shell, loose, lgt gray, (2.5Y7/2), dry.	SDFN	SP
5	X	10,10 8,12	88	1.5	0	SAND, fine to med, trace silt, ltl to some shell, firm, lgt yellowish brown (2.5Y6/3), wet.	SDFN	
						SAND, fine to med, trace silt, ltl shell, firm, lgt yellowish brown (2.5Y6/3), wet; at 11.0 to 12.0 SAND, coarse to fine, ltl silt, and shell, firm greenish gray (5BG5/1), wet.		
10	X	6,8, 8,10	100	8.7	0		SDFN/ SDCR	SW

Boring terminated at 13.0 ft.

Lithologic descriptions based on split spoon samples collected from monitoring well 1381-MWD05 borehole.

WELL DIAGRAM



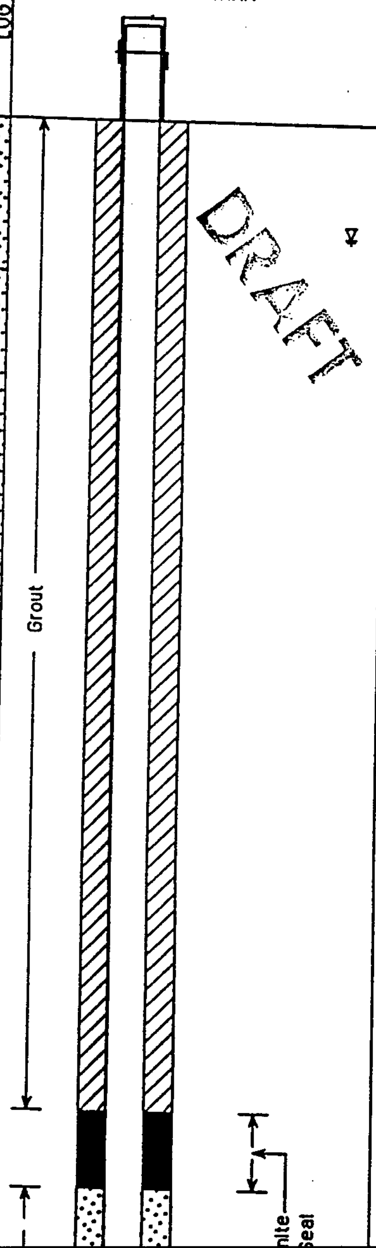
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWI05
Geologist/Engineer Federico Artioli
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 25-Jan-96
Date Completed 25-Jan-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 35.0
Ground Elevation (ft) 7.68
X-Coordinate 797001.80
Y-Coordinate 1504452.00

Client 45th Space Wing
Date Installed 25-Jan-96
Date Grouted 25-Jan-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 3 to -30
Screened Interval (ft) -30 to -35
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 35.0
Depth to Water BTOC (ft) 6.61
Date Measured 04-Apr-96
TOC Elevation (ft) 11.28
Water Level MSL (ft) 4.67

(feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	0	0	Lithology defined by nearby monitoring well 1381-MWD05 soil boring log. No split spoon samples taken at this location.		SP	
5		5,5, 4,5	60	0	0	SAND, med to fine, some shell, loose, light yellow brown, (10YR6/4), wet.	SDMD	SM	
10		4,9, 12,14	70	7	0	SAND, med to v. fine, ltl shell, trace silt, loose, greenish gray (5GY5/1).	SDFN		
15		10,5, 20,23	30	50	30	SAND, v. fine, firm, greenish gray (5GY5/1).	SDVF		
20		3,5, 7,7	70	40	>1000	SAND, v. fine, firm, greenish gray (5GY5/1).	SDVF		
25		6,4, 6,8	70	0	>1000	SAND, coarse to fine, some shell, loose, greenish gray (5G5/1).	SDMD		
		3,3, 2,2	60	0	>1000	SAND, fine to v. fine, trace shell, firm, greenish gray (5GY5/1).	SDFN		

WELL DIAGRAM



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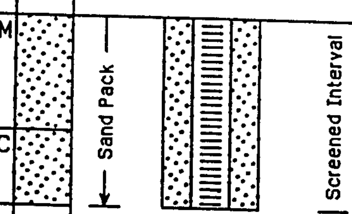
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWI05
Geologist/Engineer Federico Artioli

Project I.D. CCAS RFI - 727576
Client 45th Space Wing
Date Installed 25-Jan-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG	WELL DIAGRAM
30		1,3, 3,2	40	0	>1000	SAND, med to fine, some silt, trace shell, trace clay, firm, dark greenish gray (5GY4/1).	SDSL	SM SC		
35						Boring terminated at 35 ft.				
40										
45										
50										
55										
60										
65										



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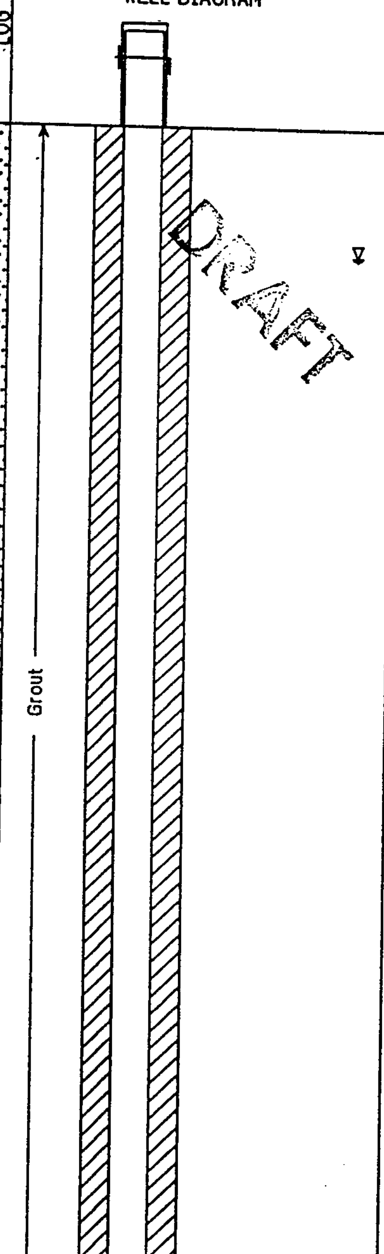
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD05
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 29-Feb-96
Date Completed 29-Feb-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 49.5
Ground Elevation (ft) 7.68
X-Coordinate 797009.79
Y-Coordinate 1504444.11

Client 45th Space Wing
Date Installed 29-Feb-96
Date Grouted 29-Feb-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -44.0
Screened Interval (ft) -44.0 to -49.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 49.5
Depth to Water BTOC (ft) 5.96
Date Measured 04-Apr-96
TOC Elevation (ft) 10.32
Water Level MSL (ft) 4.36

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
		NA	NA	NA	0	Fill material with vegetative cover.		SP	
5	X	5,5, 4,5	60	0	0	SAND, medium to fine, some shell, loose, lgt yellow brown, (10YR6/4), wet.	SDMD		
10	X	4,8, 12,14	70	7	0	SAND, med to v. fine, ltl shell, trace silt, loose, greenish gray (5GY5/1).	SDFN		
	X	10,5, 20,23	30	50	30	SAND, v. fine, firm, greenish gray (5GY5/1).	SDVF		
20	X	3,5, 7,7	70	40	>1000	SAND, v. fine, firm, greenish gray (5GY5/1).	SDVF		
25	X	6,4, 6,8	70	0	>1000	SAND, coarse to fine, some shell, loose, greenish gray (5G5/1).	SDMD		
	X	3,3, 3,4	60	0	>1000	SAND, fine to v. fine, trace shell, firm, greenish gray (5GY5/1).	SDFN		

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

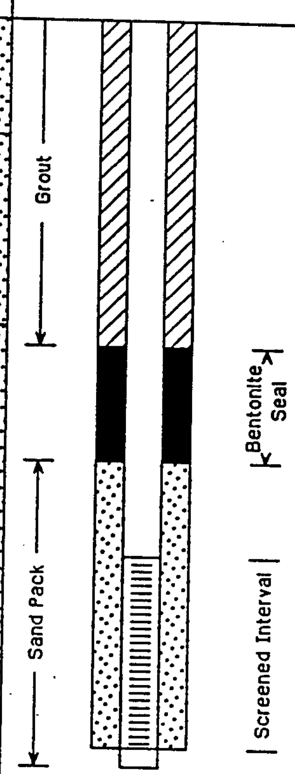
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD05
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI - 727576
Client 45th Space Wing
Date Installed 29-Feb-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30								SP
	X	1,3, 3,2	40	0	>1000	SAND, med to fine, some silt, trace shell, trace clay, firm, dark greenish gray (5GY4/1).	SDSL	SM
35								
	X	HW,HW, 2,2	40	0	>1000	SHELL, coarse, loose, some clay, dark greenish gray (5GY4/1).	SDCL	SC
	X	HW,12, 2,2	40	40	>1000	SHELL, coarse, loose, and silt, and clay, greenish gray (5GY5/1).	SDCL	
	X	2,3, 3,4	50	0	>1000	SHELL, coarse, loose, some clay stringers to 1/2-inch, drk greenish gray (5GY4/1).	SDCL	
45	X	2,1, 2,2	30	20	>1000	SAND, coarse to med, and shell, some clay, loose, drk greenish gray (5GY4/1).	SDCL	
	X	2,3, 3,3	50	150	>1000	SAND, coarse to med, and shell, some clay, loose, drk greenish gray (5GY4/1).	SDCL	
	X	HW,1, 2,1	60	70	>1000	SAND, med to fine, and shell, some silt, some clay, loose, drk greenish gray (5GY4/1). At 48.5, CLAY, firm.	SDCL/ CLAY	OH
50						Boring terminated at 49.5 ft.		
55								
60								
65								

GRAPHIC LOG

WELL DIAGRAM



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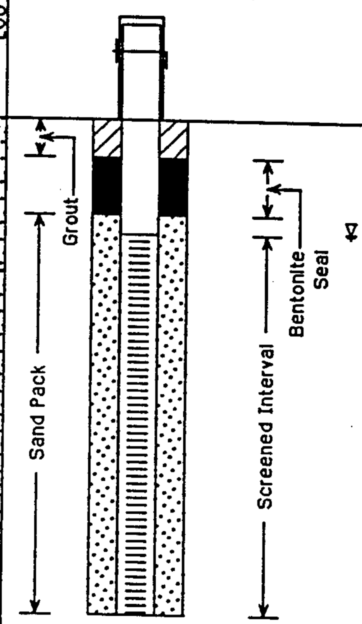
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576	Client 45th Space Wing
Installation Cape Canaveral AS	Date Installed 25-Jan-96
Site Facility 1381 - Ordnance Support Facility	Date Grouted 25-Jan-96
Boring/Well I.D. 1381-MWS06	Casing Material 2" PVC
Geologist/Engineer Federico Artioli	Screen Material 2" PVC 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) 3 to -3
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -3 to -13
Date Started 25-Jan-96	Sump Installed? No
Date Completed 25-Jan-96	Pad Installed? Yes
Driller EDS	Well Depth (ft) 13.0
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 5.94
Depth Drilled (ft) 13.0	Date Measured 04-Apr-96
Ground Elevation (ft) 7.68	TOC Elevation (ft) 10.69
X-Coordinate 797024.70	Water Level MSL (ft) 4.75
Y-Coordinate 1504466.00	

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	0	0	Lithology defined by nearby monitoring well 1381-MWD05 soil boring log. No spoon samples taken at this location.		SP	
5		5,5, 4,5	60	0	0	SAND, med to fine, some shell, loose, light yellow brown, (10YR 6/4), wet.	SDMD	SM	
10		4,9, 12,14	70	7	0	SAND, medm to v. fine, ltl shell, trace silt, loose, greenish gray (5GY 5/1).	SDFN		
15						Boring terminated at 13'.			
20									
25									

WELL DIAGRAM



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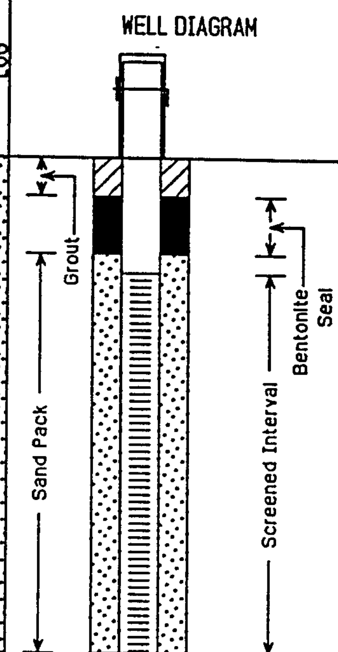
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576	Client 45th Space Wing
Installation Cape Canaveral AS	Date Installed 25-Jan-96
Site Facility 1381 - Ordnance Support Facility	Date Grouted 25-Jan-96
Boring/Well I.D. 1381-MWS07	Casing Material 2" PVC
Geologist/Engineer Federico Artioli	Screen Material 2" PVC 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) +2.5 to -3.0
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -3.0 to -13.0
Date Started 25-Jan-96	Sump Installed? No
Date Completed 21-Jan-96	Pad Installed? Yes
Driller EDS	Well Depth (ft) 13.0
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 5.28
Depth Drilled (ft) 13.0	Date Measured 04-Apr-96
Ground Elevation (ft)	TOC Elevation (ft) 10.2
X-Coordinate 797602.10	Water Level MSL (ft) 4.92
Y-Coordinate 1505755.00	

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG	WELL DIAGRAM
0–13						No split spoon samples associated with this monitoring well location.		SP		
13						Boring terminated at 13'.				

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PARSONS ENGINEERING SCIENCE

SOIL BORING LOG AND WELL CONSTRUCTION RECORD

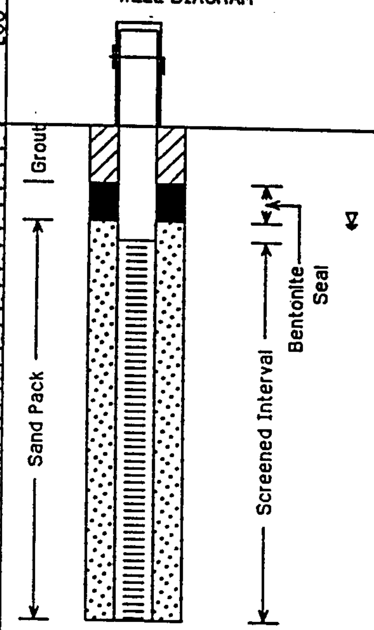
Page 1 of 1

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS08
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 21-Feb-96
Date Completed 21-Feb-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 13.0
Ground Elevation (ft) 7.17
X-Coordinate 797903.21
Y-Coordinate 1504609.52

Client 45th Space Wing
Date Installed 21-Feb-96
Date Grouted 21-Feb-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -3.0
Screened Interval (ft) -3.0 to -13.0
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft) 5.07
Date Measured 04-Apr-96
TOC Elevation (ft) 9.76
Water Level MSL (ft) 4.69

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
		NA	NA	NA	0	Fill material with vegetative cover.		SP	
		3,4, 5,8	80	200	0	SAND, coarse grained, and shell fragments, loose, yellowish brown (10YR 5/4), wet.	SDCR		
10		6,12, 8,17	80	8	0	SAND, fine to coarse grained, some shell fragments, loose, gray (N 6/)	SDCR		
15						Boring terminated at 13'.			
20									
25									

WELL DIAGRAM



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PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD08
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 21-Feb-96
Date Completed 22-Feb-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 49.5
Ground Elevation (ft) 7.38
X-Coordinate 797900.19
Y-Coordinate 1504603.00

Client 45th Space Wing
Date Installed 21-Feb-96
Date Grouted 22-Feb-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -43
Screened Interval (ft) -43 to -48
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 48.5
Depth to Water BTOC (ft) 5.38
Date Measured 04-Apr-96
TOC Elevation (ft) 10.08
Water Level MSL (ft) 4.70

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG	WELL DIAGRAM
0		NA	NA	NA	0	Fill material with vegetative cover.		SP		Grout
5	X	3,3, 5,6	70	0	100	SAND, medium to fine grained, and shell, yellowish brown (10YR 5/4), wet.	SDMD			
	X	3,5, 10,12	70	0	6	SAND, coarse to fine grained, some shell, gray (N 6/).	SDCR			
10										
	X	3,5, 9,14	100	130	>1000	SAND, fine to v. fine grained, trace silt, greenish gray (5GY 6/1).	SDFN			
15										
	X	4,4, 8,11	40	0	4	SAND, coarse to medium grained, some shell, greenish gray (5GY 5/1).	SDCR			
20										
	X	2,2, 3,3	40	0	>1000	SAND, fine grained, dark greenish gray (5GY 4/1).	SDFN			

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PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD08
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI - 727576
Client 45th Space Wing
Date Installed 21-Feb-96

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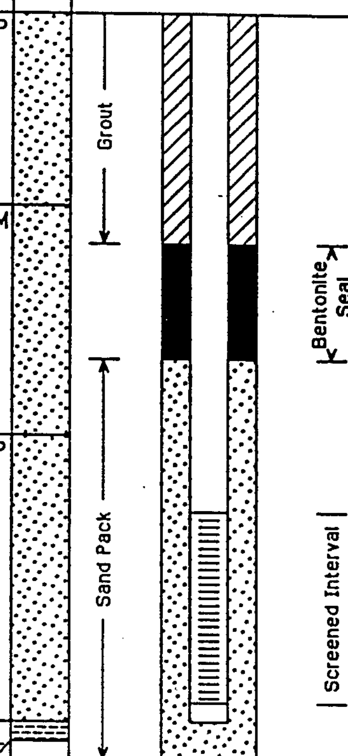
DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30								SP
	X	HW,1, 1,1	60	0	>1000	SAND, very fine grained, some silt, trace clay, dark greenish gray (5GY 4/1).	SDVF	SM
	X	2,1, 1,1	50	0	>1000	SAND, very fine, and silt, dark greenish gray (5GY 4/1).	SDSL	
	X	2,5, 5,3	60	0	>1000	SAND, fine grained, some silt, dark greenish gray (5GY 4/1).	SDFN	
	X	2,3, 3,5	30	180	>1000	SAND, fine grained, and shell, dark greenish gray (5GY 4/1).	SDFN	SP
	X					No sample, no recovery.	NSNR	
	X	NR	40	0	>1000	SAND, fine grained, trace shell, dark greenish gray (5GY 4/1), wet.	SDFN	
	X	HW,HW, 1,1	60	20	>1000	SAND, fine grained, trace shell, dark greenish gray (5GY 4/1), wet. CLAY at 48.5 feet, firm.	SDCL/ CLAY	CL
50						Boring terminated at 49.5 ft.		
55								
60								

GRAPHIC LOG

WELL DIAGRAM



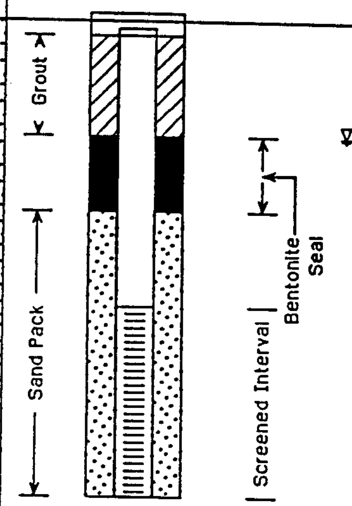
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI – 727576
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWS09
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 02-Mar-96
Date Completed 02-Mar-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 13.0
Ground Elevation (ft) 7.45
X-Coordinate 797469.30
Y-Coordinate 1504278.21

Client 45th Space Wing
Date Installed 02-Mar-96
Date Grouted 02-Mar-96
Casing Material 2" Stainless Steel
Screen Material 2" Stainless Steel 0.01 slot
Casing Interval (ft) 0.0 to -7.5
Screened Interval (ft) -7.5 to -12.5
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 12.5
Depth to Water BTOC (ft) 2.71
Date Measured 04-Apr-96
TOC Elevation (ft) 7.14
Water Level MSL (ft) 4.43

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0						Lithology defined by adjacent monitoring well 1881-MWD09 soil boring log. No split spoon samples taken at this location.		SP	
						SAND, coarse to med, and shell, v. loose, lgt yellowish brown (10YR6/4), wet.			
5									
						SAND, coarse to med, and shell, v. loose, lgt olive brown (25Y5/3), wet.			
10									
						Boring terminated at 13 ft.			
15									
20									
25									

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576	Client 45th Space Wing
Installation Cape Canaveral AS	Date Installed 03-Mar-96
Site Facility 1381 - Ordnance Support Facility	Date Grouted 03-Mar-96
Boring/Well I.D. 1381-MWD09	Casing Material 2" Stainless Steel
Geologist/Engineer Phil Potter	Screen Material 2" Stainless Steel 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) 0.0 to -44.8
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -44.8 to -49.8
Date Started 02-Mar-96	Sump Installed? No
Date Completed 03-Mar-96	Pad Installed? Yes
Driller EDS	Well Depth (ft) 49.8
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 3.44
Depth Drilled (ft) 50.0	Date Measured 04-Apr-96
Ground Elevation (ft) 7.14	TOC Elevation (ft) 7.05
X-Coordinate 797474.19	Water Level MSL (ft) 3.61
Y-Coordinate 1504275.71	

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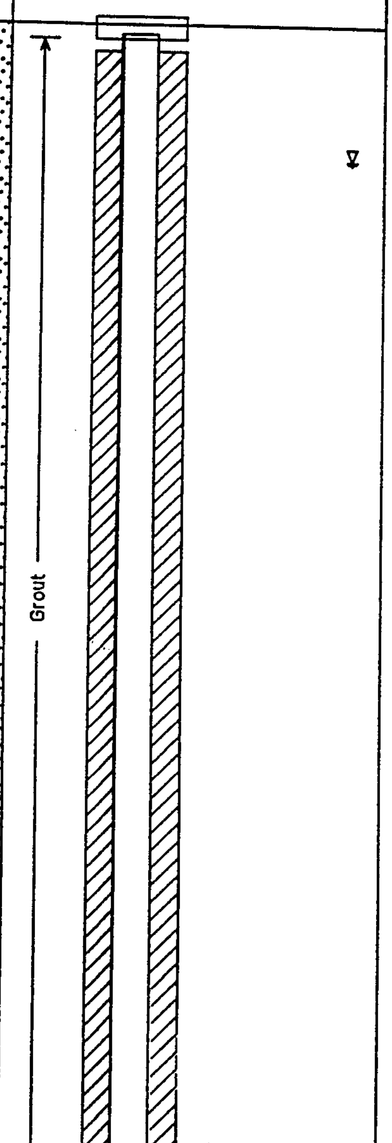
DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	NA	0	Fill material with vegetative cover.		SP	
5	X	3,4, 4,5	80	0	0	SAND, coarse to medium grained, and shell, v. loose, light yellow brown (10YR 6/4), wet.	SDCR		
10	X	2,4, 7,6	80	0	0	SAND, coarse to medium grained, and shell, very loose, light olive brown (2.5Y 5/3).	SDCR		
15	X	4,8, 15,19	70	860	150	SAND, coarse to fine grained, some shell, loose, light olive brown (2.5Y 5/3).	SDMD		
20	X	5,8, 12,15	50	720	>1000	SAND, fine grained, little shell, loose, greenish gray (5GY 6/1).	SDFN		
25	X	3,3, 4,4	70	780	12	SAND, medium to very fine grained, trace shell, loose, greenish gray (5GY 6/1).	SDFN		
	X	1,2, 3,3	40	180	500	SAND, medium to very fine grained, some shell, loose, greenish gray (5GY 5/1).	SDFN		

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

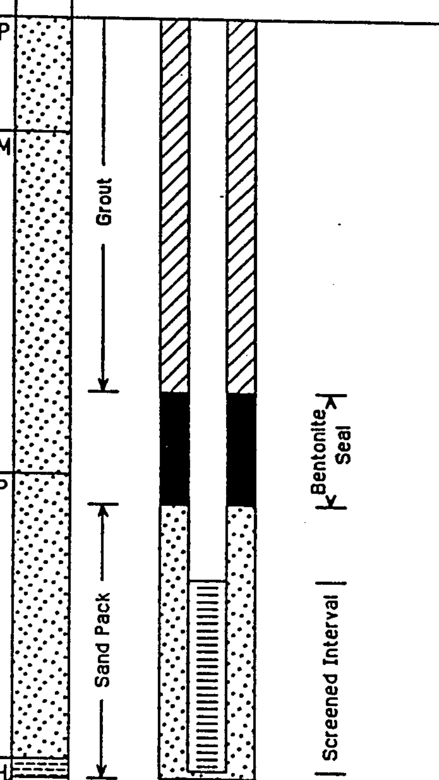
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWD09
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 03-Mar-96

-DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30								SP
35	X	1,1, 2,1	60	0	500	SAND, very fine, and silt, trace clay, firm, greenish gray (5GY 5/1).	SDSL	SM
	X	1,1, 1,2	40	0	>1000	SAND, medium to fine, some silt, firm, greenish gray (5GY 5/1).	SDFN	
40	X	1,2, 3,4	80	0	>1000	SAND, fine to v. fine, and shell, and clay, loose, greenish gray (5GY 5/1).	SDVF	
	X	2,3, 4,7	60	0	>1000	SAND, coarse to fine, little shell, trace silt, trace clay, loose, dark greenish gray (5GY 4/1).	SDCR	SP
45	X	1,3, 6,9	50	0	>1000	SAND, medium to fine, some shell, trace silt, trace clay, loose, dark greenish gray (5GY 4/1).	SDMD	
	X	2,3, 3,1	90	0	>1000	SAND, coarse to medium, some shell, trace clay, loose, dark greenish gray (5GY 4/1).	SDCR	
	X	HW,HW, 2,3	80	0	>1000	SAND, medium to fine, little shell, trace silt, loose, dark greenish gray (5GY 4/1). At 49.8, CLAY, firm.	SDMD/ CLAY	
50						Boring terminated at 50'.		OH
55								
60								
65								

GRAPHIC LOG

WELL DIAGRAM



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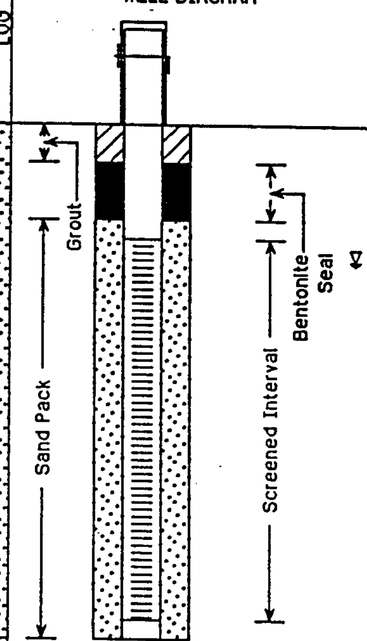
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS10
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 27-Feb-96
Date Completed 27-Feb-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 13.5
Ground Elevation (ft) 7.97
X-Coordinate 797671.13
Y-Coordinate 1504258.18

Client 45th Space Wing
Date Installed 27-Feb-96
Date Grouted 27-Feb-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -3.0
Screened Interval (ft) -3.0 to -13.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft) 6.15
Date Measured 04-Apr-96
TOC Elevation (ft) 10.55
Water Level MSL (ft) 4.40

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0						Lithology defined by adjacent monitoring well 1381-MWD10 soil boring log. No split spoon samples takn at this location		SP	
5						SAND, med to fine, and shell, loose, v. pale brown (10YR7/4), wet.	SDMD		
10						SAND, coarse to med, and shell, loose, greenish gray (5GY5/1).	SDCR		
15						Boring terminated at 13.5'.			
20									
25									

WELL DIAGRAM



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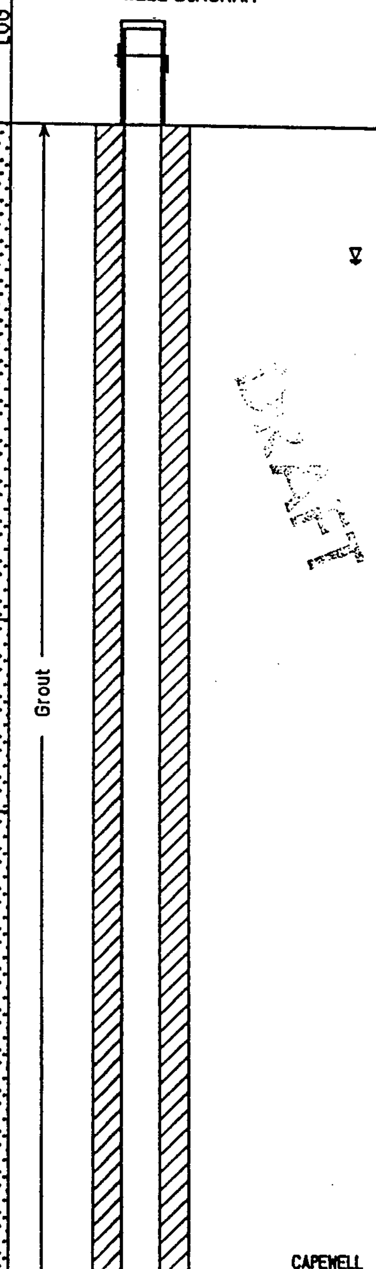
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD10
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 01-Mar-96
Date Completed 02-Mar-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 50.0
Ground Elevation (ft) 7.97
X-Coordinate 797674.51
Y-Coordinate 1504254.48

Client 45th Space Wing
Date Installed 02-Mar-96
Date Grouted 02-Mar-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -44.5
Screened Interval (ft) -44.5 to -49.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 50
Depth to Water BTOC (ft) 6.31
Date Measured 04-Apr-96
TOC Elevation (ft) 10.84
Water Level MSL (ft) 4.53

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	NA	0	Fill material with vegetative cover.		SP	
5	X	4,5, 6,9	80	0	0	SAND, medium to fine grained, and shell, loose, very pale brown (10YR 7/4), wet.	SDMD		
10	X	2,5, 4,3	80	7	0	SAND, coarse to medium grained, and shell, loose, greenish gray (5GY 5/1).	SDCR		
15	X	5,6, 10,15	70	7	0	SAND, very fine grained, trace silt, firm, greenish gray (5GY 5/1).	SDVF	SM	
20	X	5,6, 12,14	80	110	500	SAND, medium to fine grained, some shell, firm, greenish gray (5GY 5/1).	SDFN	SP	
25	X	1,2, 2,5	40	0	500	SAND, coarse to fine grained, some shell, loose, greenish gray (5 G 4/1)	SDMD		
	X	1,2, 2,1	40	30	500	SAND, fine to very fine grained, trace shell, firm, greenish gray (5GY 5/1).	SDFN		

WELL DIAGRAM



CAPEWELL

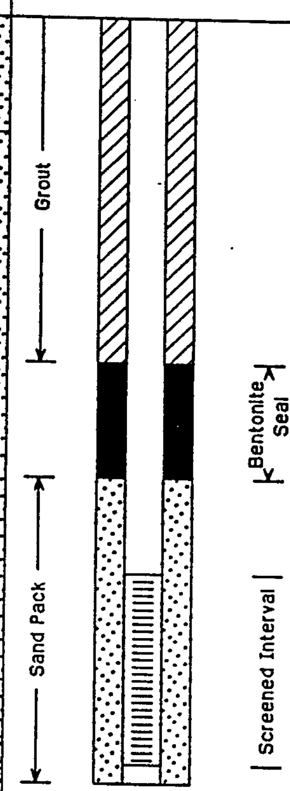
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWD10
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 02-Mar-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30								SP
35	X	1,3, 2,3	80	0	>1000	SAND, coarse to fine, some silt, some shells, loose, dark greenish gray (5GY 4/1).	SDSL	SM
	X	1,2, 2,1	70	40	600	SAND, very fine grained, and silt, and clay, firm, greenish gray (5GY 5/1).	SDCL	
40	X	NR	60	0	>1000	SAND, very fine grained, and silt, and clay, little shell, firm, greenish gray (5GY 4/1).	SDCL	
45	X	NR	50	0	>1000	SAND, coarse to fine, and clay, some shell, some silt, loose to firm, greenish gray (5GY 5/1).	SDCL	
	X	2,1, 1,1	60	80	>1000	SAND, coarse to fine, and shell, and clay, loose, greenish gray (5GY 5/1).	SDCL	
50	X	1,2	80	0	>1000	SAND, medium to fine, loose, greenish gray (5GY 5/1), wet. CLAY at 49.5 feet, firm.	SDMD/ CLAY	SP / OH
						Boring terminated at 50'.		
55								
60								
65								

WELL DIAGRAM



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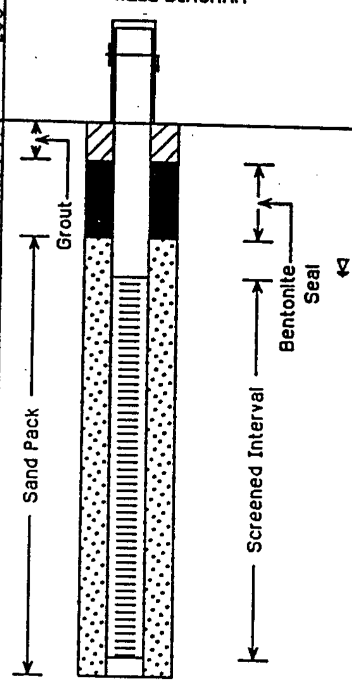
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS11
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 28-Feb-96
Date Completed 28-Feb-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 14.5
Ground Elevation (ft) 8.08
X-Coordinate 797178.06
Y-Coordinate 1504193.92

Client 45th Space Wing
Date Installed 28-Feb-96
Date Grouted 28-Feb-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -4.0
Screened Interval (ft) -4.0 to -14.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 14.5
Depth to Water BTOC (ft) 6.51
Date Measured 04-Apr-96
TOC Elevation (ft) 10.86
Water Level MSL (ft) 4.35

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0						Lithology defined by adjacent monitoring well 1381-MWD11 soil boring log. No split spoon samples taken at this location.		SP	
5						SAND, med to fine, some shell, loose, pale brown (10YR7/4)			
						SAND, med to fine, trace silt, ltl shell, gray (N5/)			
10						DRAFT			
15						Boring terminated at 14.5 ft.			
20									
25									

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD11
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 28-Feb-96
Date Completed 28-Feb-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 50.0
Ground Elevation (ft) 8.33
X-Coordinate 797182.42
Y-Coordinate 1504188.81

Client 45th Space Wing
Date Installed 28-Feb-96
Date Grouted 28-Feb-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -44.5
Screened Interval (ft) -44.5 to -49.5
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 50
Depth to Water BTOC (ft) 6.62
Date Measured 04-Apr-96
TOC Elevation (ft) 10.96
Water Level MSL (ft) 4.34

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG	WELL DIAGRAM
0		NA	NA	NA	0	Fill material with vegetative cover.		SP		
5	X	5,6, 8,8	80	0	0	SAND, medium to fine grained, some shell, loose, pale brown (10YR 7/4), wet.	SDMD			
10	X	2,2, 2,2	50	2	0	SAND, medium to fine grained, trace silt, little shell, gray (N 5/).	SDMD			
15	X	3,3, 9,10	60	2	0	SAND, fine to very fine grained, trace shell, greenish gray (5GY 6/1).	SDFN			Grout
20	X	3,4, 5,4	30	80	0	SAND, fine to very fine grained, greenish gray (5GY 6/1).	SDFN			
25	X	2,3, 3,4	30	0	0	SAND, fine to very fine grained, and silt, greenish gray (5GY 5/1).	SDSL	SM		
	X	2,3, 3,3	30	0	0	SAND, fine to very fine grained, and silt, greenish gray (5GY 5/1).	SDSL			

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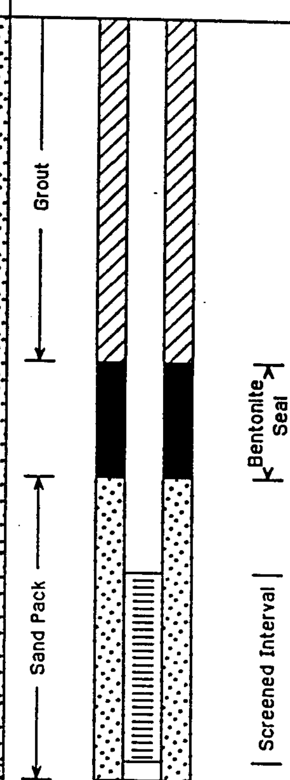
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWD11
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 28-Feb-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd – Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
30								SM	
33–35	X	2,2, 3,4	30	70	0	SAND, very fine, and silt, trace clay, trace shell, dark greenish gray (5GY 4/1).	SDSL		
38–40	X	1,1, 1,1	70	0	0	SAND, fine to v. fine grained, some silt, greenish gray (5GY 5/1).	SDVF		
40–42	X	1,2, 4,5	50	0	0	SAND, very fine grained, and shell, and clay, greenish gray (5GY 6/1).	SDVF		
42–44	X	1,2, 4,1	80	0	0	SAND, fine, some clay, and shell, greenish gray (5GY 5/1).	SDFN		
44–46	X	1,0, 0,5	60	0	0	SHELLS, coarse, some clay, loose, very dark gray (N 3/).	SDCR	SP	
46–48	X	3,5, 6,5	80	0	0	SAND, medium to fine, and shell, trace clay, dark greenish gray (5GY 4/1).	SDMD		
48–50	X	1,2, 1,2	80	30	0	SAND, and clay, some shell, greenish gray (5GY 5/1). CLAY at 49.5, firm.	SDCL/ CLAY	SM / OH	
50						Boring terminated at 50'.			
55									
60									
65									

WELL DIAGRAM



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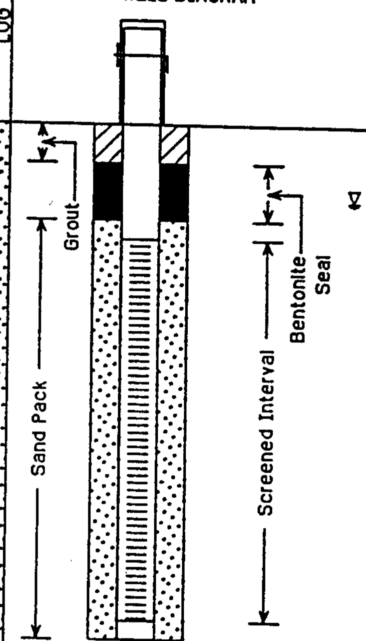
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI – 727576
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWS12
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 03-Mar-96
Date Completed 03-Mar-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 14.0
Ground Elevation (ft) 6.88
X-Coordinate 798083.35
Y-Coordinate 1505429.89

Client 45th Space Wing
Date Installed 03-Mar-96
Date Grouted 03-Mar-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to –3.0
Screened Interval (ft) –3.0 to –13.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.5
Depth to Water BTOC (ft) 4.71
Date Measured 04-Apr-96
TOC Elevation (ft) 9.62
Water Level MSL (ft) 4.91

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd – Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0						Lithology defined by adjacent monitoring well 1381-MWD12 soil boring log. No split spoon samples taken at this location.		SP	
						SAND, coarse to med, and shell, loose, brownish yellow (10YR6/6), wet.			
5									
						SAND, med to fine, trace shell, firm, greenish gray (5GY6/1)			
10									
15						Boring terminated at 14.0 ft.			
20									
25									

WELL DIAGRAM



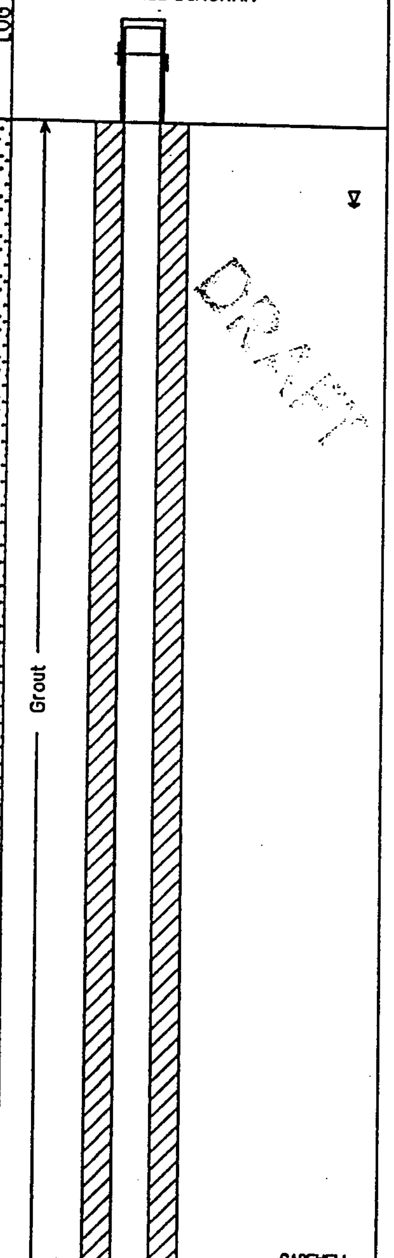
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD12
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 04-Mar-96
Date Completed 04-Mar-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 50.0
Ground Elevation (ft) 6.96
X-Coordinate 798088.61
Y-Coordinate 1505427.46

Client 45th Space Wing
Date Installed 04-Mar-96
Date Grouted 04-Mar-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -44.0
Screened Interval (ft) -44.0 to -49.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 49.5
Depth to Water BTOC (ft) 4.63
Date Measured 04-Apr-96
TOC Elevation (ft) 9.60
Water Level MSL (ft) 4.97

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	NA	0	Fill material with vegetative cover.		SP	
5	X	4,4, 7,7	80	0	0	SAND, coarse to medium grained, and shell, loose, brownish yellow (10YR 6/6), wet.	SDCR		
10	X	8,8, 12,19	90	4	0	SAND, medium to fine grained, trace shell, firm, greenish gray (5GY 6/1).	SDMD		
15	X	8,9, 17,29	80	0	18	SAND, medium to fine grained, little shell, very firm, greenish gray (5GY 6/1).	SDMD		
20	X	4,4, 6,7	60	0	6	SAND, fine to very fine, trace shell, greenish gray (5GY 6/1).	SDFN		
25	X	4,4, 5,5	70	0	0	SAND, fine to very fine grained, trace silt, trace shell, greenish gray (5GY 5/1).	SDVF		
	X	HW,2, 1,1	70	0	>1000	SAND, very fine grained, some silt, trace shell, firm, greenish gray (5GY 5/1).	SDSL	SM	

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWD12
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 04-Mar-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
30–33								SM	
33–35	X	1,2, 2,1	80	0	>1000	SAND, very fine, and silt, trace shell, firm, greenish gray (5GY 5/1).	SDSL		
38–40	X	HW,1, 5,5	70	0	>1000	SAND, medium to fine, and shell, and silt, some clay, loose to firm, greenish gray (5GY 5/1).	SDCL		
40–42	X	3,4, 4,3	60	0	>1000	SAND, fine to v. fine, and shell, loose, dark greenish gray (5GY 4/1).	SDFN	SP	
46–48	X	HW,HW, 1,1	80	0	>1000	SAND, coarse to fine, and shell, some clay, loose, dark greenish gray (5GY 4/1).	SDCL	SM	
48–50	X	HW,HW, 2,2	100	200	>1000	SAND, coarse to fine, and shell, and clay, loose, dark greenish gray (5GY 4/1). At 49.5; CLAY, little wood chips, dark greenish gray (5GY 4/1).	SDCL/ CLAY	OH	

Boring terminated at 50'.

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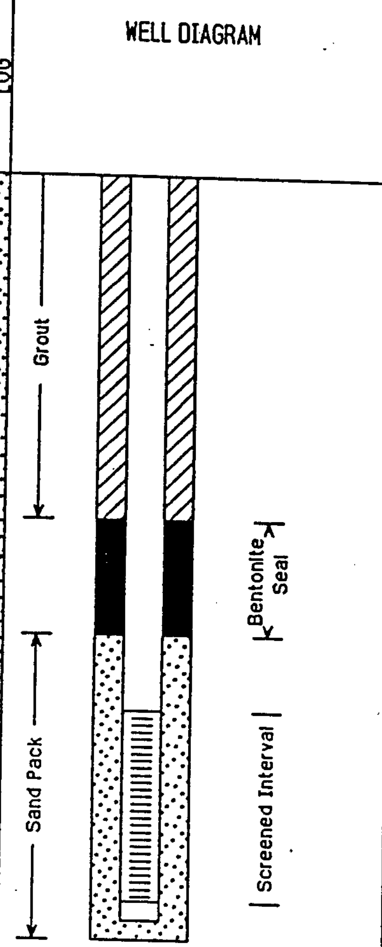


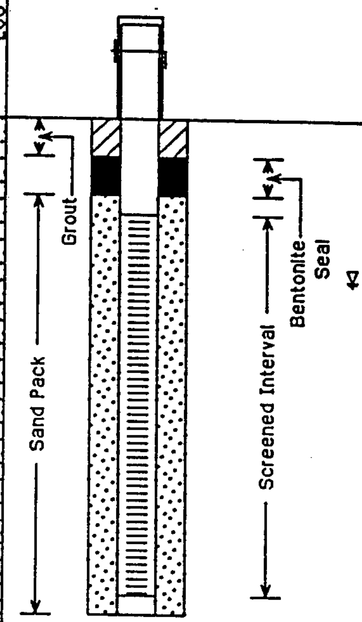
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Page 1 of 1

Project I.D. CCAS RFI - 727576	Client 45th Space Wing
Installation Cape Canaveral AS	Date Installed 13-Mar-96
Site Facility 1381 - Ordnance Support Facility	Date Grouted 13-Mar-96
Boring/Well I.D. 1381-MWS13	Casing Material 2" PVC
Geologist/Engineer Phil Potter	Screen Material 2" PVC 0.01 slot
Drilling Method Hollow Stem Auger	Casing Interval (ft) 3 to -2.5
Sampling Method 2 1/4" Split Spoon	Screened Interval (ft) -2.5 to -12.5
Date Started 13-Mar-96	Sump Installed? Yes
Date Completed 13-Mar-96	Pad Installed? Yes
Driller EDS	Well Depth (ft) 13.0
Borehole Diameter (in) 10.25	Depth to Water BTOC (ft) 6.50
Depth Drilled (ft) 13.0	Date Measured 04-Apr-96
Ground Elevation (ft) 8.62	TOC Elevation (ft) 10.91
X-Coordinate 796624.10	Water Level MSL (ft) 4.41
Y-Coordinate 1505592.71	

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0						Lithology defined by split spoon samples collected at adjacent monitoring well 1381-MWD13.		SP	
5						SAND, coarse to med, and shell, v. loose, yellow, 10YR7/6, wet.			
						SAND, v. coarse to med, and shell, v. loose, greenish gray, 5Y5/1, wet.			
10						DRAFT			
15						Boring terminated at 13 ft.			
20									
25									

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE

SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD13
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 12-Mar-96
Date Completed 12-Mar-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 50.0
Ground Elevation (ft) 8.62
X-Coordinate 796626.89
Y-Coordinate 1505601.33

Client 45th Space Wing
Date Installed 12-Mar-96
Date Grouted 12-Mar-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 3 to -44.5
Screened Interval (ft) -44.5 to -49.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 50.0
Depth to Water BTOC (ft) 6.21
Date Measured 04-Apr-96
TOC Elevation (ft) 10.85
Water Level MSL (ft) 4.64

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0						Vegetation at surface.		SP	
5	X	6,7, 5,10	60	2	0	SAND, coarse to med, and shell, v. loose, yellow, 10YR7/6, wet.	SDCR		
10	X	2,3, 5,8	30	0	0	SAND, v. coarse to med, and shell, v. loose, greenish gray, 5Y5/1, wet.	SDCR		
15	X	2,4, 5,5	40	0	0	SAND, coarse to fine, some shell, loose, greenish gray, 5GY5/1, wet.	SDMD		
20	X	3,4, 4,8	20	0	400	SAND, coarse to fine, some shell, loose, greenish gray, 5GY5/1, wet.	SDMD		
25	X	3,4, 4,4	10	0	100	SAND, med to v. fine, ltl shell, firm, greenish gray, 5GY5/1, wet.	SDFN		
	X	4,3, 4,4	30	90	30	SAND, v. fine, and silt, firm, greenish gray, 5GY5/1, wet.	SDSL	SM	

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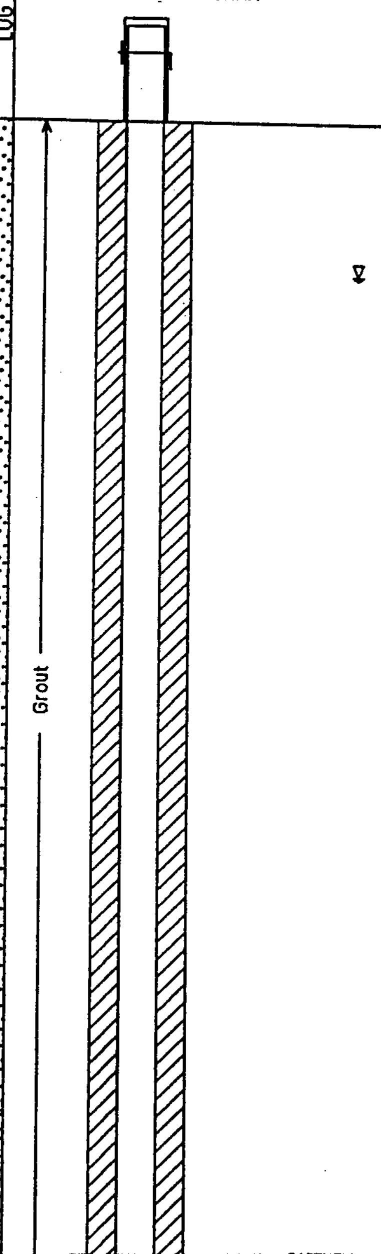
WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

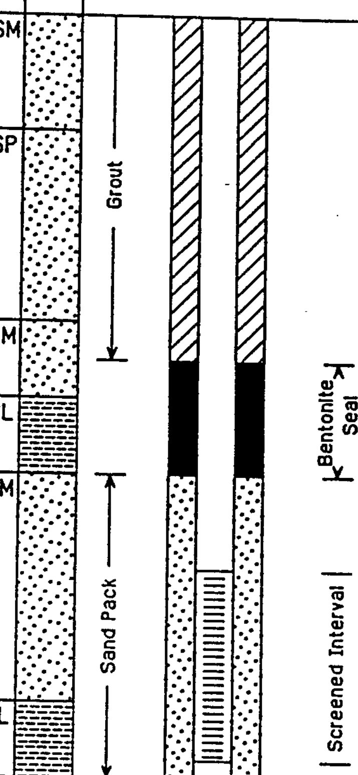
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWD13
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 12-Mar-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd – Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30								SM
35	X	1,2, 2,1	60	0	>1000	SAND, med to fine, ltl shell, firm, greenish gray, 5GY5/1, wet.	SDFN	SP
	X	HW,1, 1,1	30	0	>1000	SAND, v. fine, and silt, some clay, firm, dk. greenish gray, 5GY5/1, wet.	SDSL	SM
40	X	1,3, 2,7	30	0	>1000	SAND, v. fine, and silt, and clay, ltl shell, firm, dk. greenish gray, 5GY4/1, wet.	SDCL	CL
	X	3,1, 3,5	30	110	>1000	SAND, med to v. fine, and silt, some clay, some shell, firm, dk. greenish gray, 5GY4/1, wet.	SDSL	SM
45	X	1,1, 1,1	20	0	>1000	SAND, v. fine, and silt, ltl clay, firm, dk. greenish gray, 5GY4/1, wet.	SDSL	
	X	HW,HW, HW,3	20	0	>1000	SAND, med to v. fine, and silt, some clay, ltl shell, firm, greenish gray, 5GY5/1, wet.	SDSL	
50	X	1,1, 1,1	20	0	>1000	SAND, fine to v. fine, some silt, ltl shell, firm, greenish gray, 5GY5/1, wet. 3" CLAY layer	SDCL	CL
						Boring terminated at 50'.		
55								
60								
65								

GRAPHIC LOG

WELL DIAGRAM



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PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI – 727576
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWS14
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 12-Mar-96
Date Completed 12-Mar-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 14.5
Ground Elevation (ft) 8.23
X-Coordinate 798494.39
Y-Coordinate 1506002.99

Client 45th Space Wing
Date Installed 12-Mar-96
Date Grouted 12-Mar-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 0.0 to -4.0
Screened Interval (ft) -4.0 to -14.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 14.5
Depth to Water BTOC (ft) 3.50
Date Measured 04-Apr-96
TOC Elevation (ft) 8.24
Water Level MSL (ft) 4.74

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	NA	0	Fill material with vegetative cover.		SP	
5	X	2,4, 6,4	80	0	0	SAND, coarse to medium grained, and shell, loose, yellowish brown (10YR 5/4), wet.	SDCR		
10	X	1,1, 1,2	20	3	0	SAND, very coarse to medium, and shell, loose, gray (N 5/), wet.	SDCR		
15						Boring terminated at 14.5'.			
20									
25									

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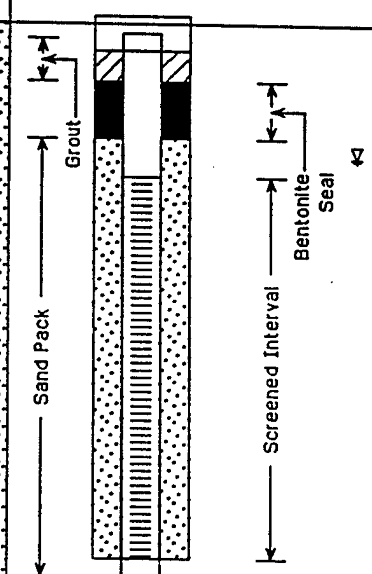
WELL DIAGRAM



PARSONS ENGINEERING SCIENCE

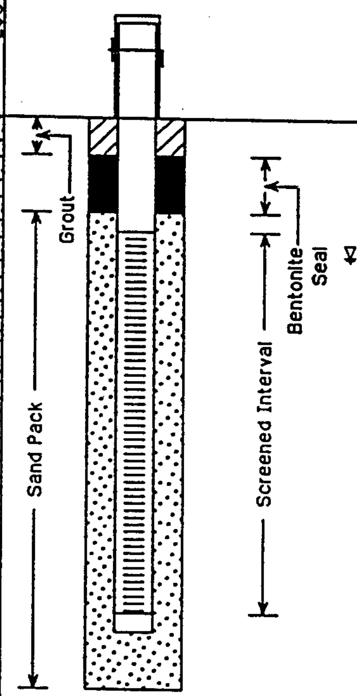
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI – 727576
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWS15
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 19-Mar-96
Date Completed 19-Mar-96
Driller EDS
Borehole Diameter (in) 10.25
Depth Drilled (ft) 15.0
Ground Elevation (ft) 7.79
X-Coordinate 798915.22
Y-Coordinate 1506601.74

Client 45th Space Wing
Date Installed 19-Mar-96
Date Grouted 19-Mar-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -3.0
Screened Interval (ft) -3.0 to -13.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.5
Depth to Water BTOC (ft) 6.27
Date Measured 04-Apr-96
TOC Elevation (ft) 10.44
Water Level MSL (ft) 4.17

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	0	0	Fill material with vegetative cover.	SDMD	SP	
5	X	5,8, 8,5	90	0	0	SAND, medium to fine grained, little shell, very loose, very pale (10YR 7/3), wet.	SDMD		
10	X	4,7, 9,4	30	0	10	SAND, medium to fine, trace shell, very loose, greenish gray (5GY 6/1), wet.	SDMD		
15						Boring terminated at 15.0 ft.			
20									
25									

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWI09
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 17-May-96
Date Completed 17-May-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 36.0
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 17-May-96
Date Grouted 17-May-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 3 to -30.0
Screened Interval (ft) -30.0 to -35.0
Sump Installed? No
Pad Installed? Yes
Well Depth (ft) 35.0
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
0		NA	NA	NA	0	Fill with vegetative cover.		SP
5	X	5,4, 4,3	40	0	0	SAND, medium to fine grained, and shell, very loose, light yellowish brown (10YR6/4), wet.	SDMD	
10	X	4,3, 4,4	30	20	180	SAND, coarse to fine, and shell, very loose, olive brown (2.5Y4/4).	SDCR	
15	X	5,5, 4,5	40	760	450	SAND, medium to fine, and shell, very loose, gray (2.5YR5/1).	SDFN	
20	X	7,7, 6,5	60	500	600	SAND, coarse to fine, trace shell, loose, greenish gray (5GY5/1).	SDVF	
	X	4,4, 7,6	70	540	600	SAND, fine to very fine, trace shell, firm, greenish gray (5GY5/1).	SDFN	
25	X	3,3, 2,3	80	0	>1000	SAND, fine to very fine, little shell, firm, greenish gray (5GY5/1).	SDFN	
	X	4,4, 3,2	70	130	330	SAND, fine to very fine, firm, greenish gray (5GY5/1).	SDVF	
	X	4,4, 3,4	70	0	400	SAND, fine to very fine, very firm, greenish gray (5GY5/1).	SDVF	

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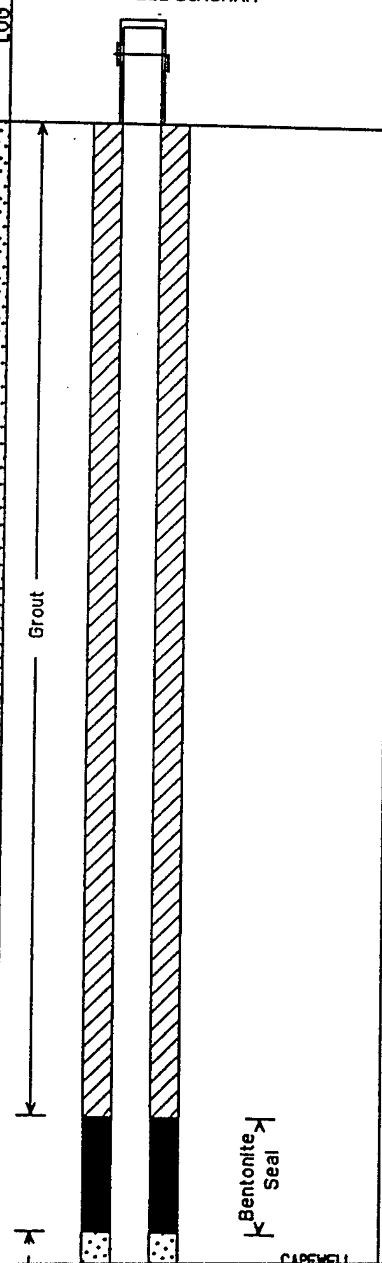
GRAPHIC LOG

WELL DIAGRAM



PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

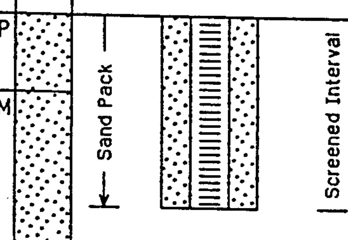
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWI09
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 17-May-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30	X	2,2, 3,5	70	190	>1000	SAND, fine to very fine, trace silt, trace shell, very firm, greenish gray (5GY5/1).		SP
	X	2,2, 2,2	100	0	12	SAND, very fine, some silt, little shell, trace clay, firm, greenish gray (5GY5/1).	SDSL	SM
35	X	2,2, 3,4	90	0	>1000	SAND, very fine, and silt, little clay, little shell, firm, greenish gray (5GY5/1), wet.	SDSL	
						Boring terminated at 36.0'.		
40								
45								
50								
55								
60								
65								

GRAPHIC LOG

WELL DIAGRAM



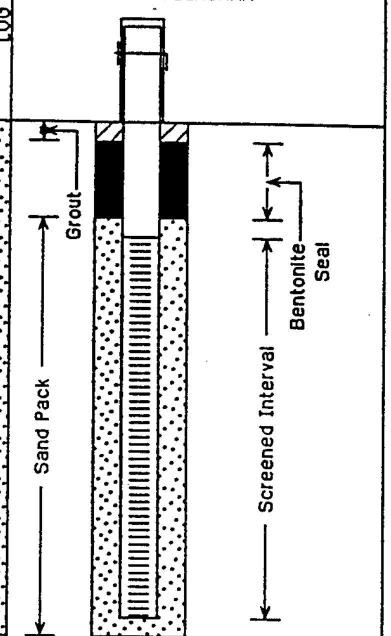
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS16
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 20-May-96
Date Completed 20-May-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 13.5
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 20-May-96
Date Grouted 20-May-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -3.0
Screened Interval (ft) -3.0 to -13.0
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.5
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	0	0	Fill material with vegetative cover.	SDMD	SP	
5	X	4,6, 7,5	40	0	3	SAND, coarse to fine grained, and shell, very loose, yellowish brown (10YR 6/4), wet.	SDMD		
10	X	5,5, 6,5	40	0	0	SAND, medium to very fine, little shell, firm, gray (10YR5/1), wet.	SDFN		
						Boring terminated at 13.5 ft.			
15									
20									
25									

WELL DIAGRAM



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CAPEWELL

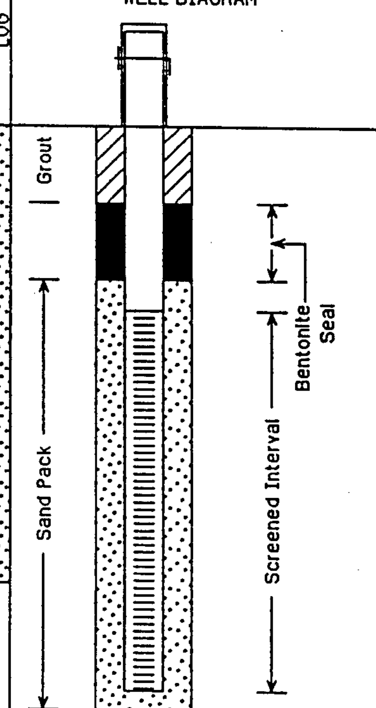
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS17
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 18-May-96
Date Completed 18-May-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 15.3
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 18-May-96
Date Grouted 18-May-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 3 to -4.8
Screened Interval (ft) -4.8 to -14.8
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 15.3
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	NA	0	Fill with vegetative cover.		SP	
5	X	4,4, 3,5	70	0	0	SAND, medium to fine grained, little shell, very loose, light yellowish brown (10YR6/4), wet at 7' bls.	SDMD		
10	X	5,7, 7,9	60	0	1	SAND, medium to fine, some shell, firm, gray (10YR6/1), wet.	SDMD		
15						Boring terminated at 15.3'.			
20									
25									

WELL DIAGRAM



CAPEWELL

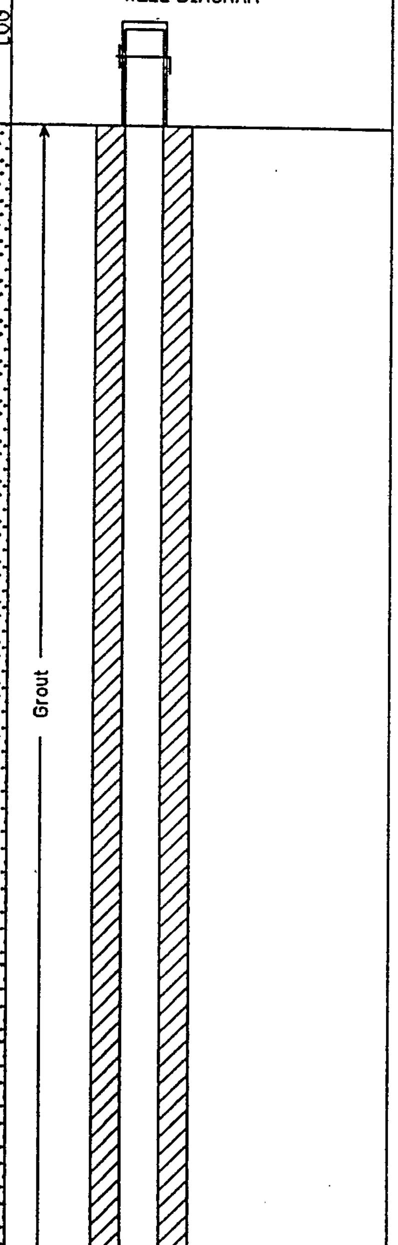
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD17
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 18-May-96
Date Completed 18-May-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 51.0
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 18-May-96
Date Grouted 18-May-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 3 to -45.5
Screened Interval (ft) -45.5 to -50.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 51.0
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
0		NA	NA	NA	0	Fill with vegetative cover.		SP
5	X	5,4, 3,6	40	0	0	SAND, medium to fine grained, trace shell, very loose, very pale brown (10YR7/3), moist.	SDMD	
10	X	3,4, 4,6	70	0	3	SAND, coarse to fine, some shell, loose, gray (10YR5/). wet.	SDCR	
15	X	5,5, 6,5	80	0	12	SAND, medium to fine, little shell, loose, gray (10YR5/).	SDMD	
20	X	4,4, 3,4	50	0	0	SAND, fine to very fine, trace shell, firm, greenish gray (5GY5/1).	SDFN	
	X	5,5, 6,7	80	0	>1000	SAND, fine, little shell, firm, greenish gray (5GY5/1).	SDFN	SW
25	X	5,5, 5,6	90	0	>1000	SAND, medium to fine, little shell, firm, gray 10YR6/1).	SDMD	SP
	X	4,4, 4,4	60	0	>1000	SAND, medium to fine, little shell, firm, gray (10YR6/1).	SDFN	
	X	3,3, 4,4	60	0	>1000	SAND, fine to very fine, trace shell, firm, greenish gray (5GY5/1).	SDVF	

WELL DIAGRAM



CAPEWELL

PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

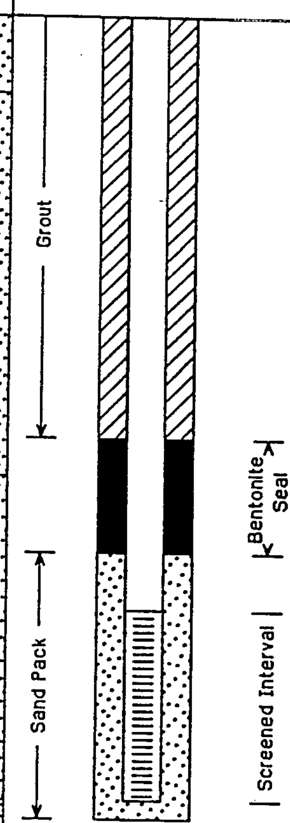
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-MWD17
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI – 727576
Client 45th Space Wing
Date Installed 18-May-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd – Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30	X	3,5, 7,8	90	0	>1000	~~SAND, fine to very fine, trace shell, firm,~~ greenish gray (5GY5/1).		SP
	X	3,3, 4,4	70	0	100	SAND, fine to very fine, some silt, firm, greenish gray (5GY5/1).	SDSL	SM
35	X	4,4, 4,4	80	0	80	SAND, fine to very fine, some silt, little clay, trace shell, greenish gray (5GY5/1).	SDSL	
	X	3,3, 2,3	80	10	>1000	SAND, medium to fine grained, and silt, and clay (stringers to 1"), loose to firm, greenish gray (5GY5/1).	SDSL	
	X	3,3, 3,3	90	0	>1000	SAND, medium to very fine, and silt, some shell, some clay, loose, dark greenish gray (5GY4/1).	SDSL	
40	X	4,7, 7,4	90	0	>1000	SAND, fine, and shell, some clay, loose, dark greenish gray (5GY4/1).	SDSL	
	X	3,3, 3,5	90	20	>1000	SHELLS, coarse to medium, some clay, loose, dk. greenish gray (5GY4/1)	SDMD	SP
45	X	3,6 6,5	60	0	>1000	SAND, medium to very fine, and shell, little silt, little clay, loose, dark greenish gray (5GY4/1). 2-inch silty clay layer at 45'.	SDFN	
	X	4,4, 5,4	90	0	320	SAND, medium to fine, and shell, some clay, loose, dark greenish gray (5GY4/1).	SDCL	
	X	5,7, 7,10	90	0	>1000	SAND, medium to fine, and shell, some to little clay, firm to loose, dark greenish gray (5GY4/1), wet.	SDFN	
50	X	5,7, 7,10	100	70	>1000	SAND, medium to fine, and shell, some clay, firm, dark greenish gray (5GY4/1), wet.	SDCL/	SM
						CLAY, very firm, dark greenish gray (5GY4/1), moist.	CLAY	CL
						Boring terminated at 51.0'.		
55								
60								
65								

GRAPHIC LOG

WELL DIAGRAM



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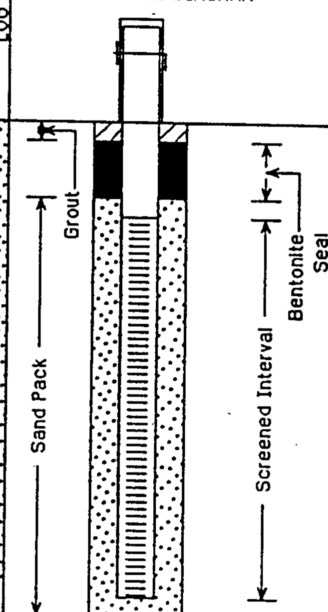
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWS18
Geologist/Engineer Louis Bustamante
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 17-May-96
Date Completed 17-May-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 13.0
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 17-May-96
Date Grouted 17-May-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 3 to -2.5
Screened Interval (ft) -2.5 to -12.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	NA	0	Fill.		SP	
5	X	NA	80	0	1	SAND, coarse to medium grained, and shell, very loose, brown (10YR5/3) wet.	SDMD		
10	X	NA	30	11	3	SAND, coarse to fine, and shell, very loose, gray (10YR5/), wet.	SDMD		
15						Boring terminated at 13.0'.			
20									
25									

WELL DIAGRAM



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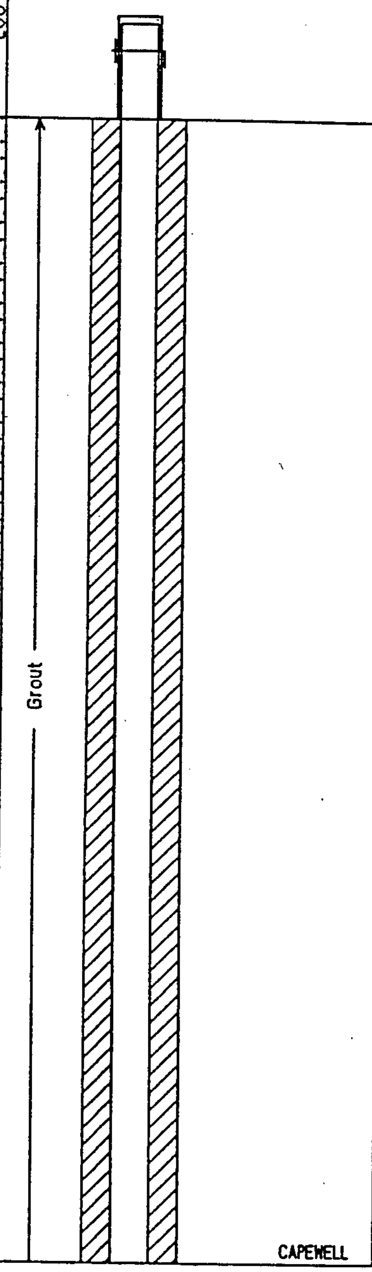
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD19
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 19-May-96
Date Completed 19-May-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 50.0
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 19-May-96
Date Grouted 19-May-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) 3 to -44.5
Screened Interval (ft) -44.5 to -49.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 50.0
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	NA	0	Fill with vegetative cover.		SP	
5	X	5,4, 4,5	30	0	0	SAND, coarse to fine, some shell, loose, gray (10YR6/1), wet.	SDCR		
10	X	4,4, 7,9	20	0	1	SAND, coarse to medium, and shell, loose, gray (10YR6/1).	SDCR		
15	X	7,7, 8,12	70	0	>1000	SAND, medium to fine, little shell, firm, greenish gray (5GY5/1).	SDMD		
20	X	5,5, 6,5	50	0	>1000	SAND, very fine, trace silt, trace shell, firm, greenish gray (5GY5/1).	SDVF	SW	
	X	5,7, 7,10	70	0	>1000	SAND, fine to v. fine, trace shell, firm, greenish gray (5GY5/1).	SDFN	SP	
25	X	7,7, 5,7	90	0	600	SAND, fine to v. fine, trace silt, firm, greenish gray (5GY5/1).	SDFN		
	X	7,10, 11,9	90	0	>1000	SAND, very fine, some silt, trace clay, firm, greenish gray (5GY5/1).	SDSL	SM	
	X	6,6, 5,7	90	0	280	SAND, fine to v. fine, trace silt, trace shell, firm, greenish gray (5GY5/1).	SDVF	SP	

WELL DIAGRAM



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PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

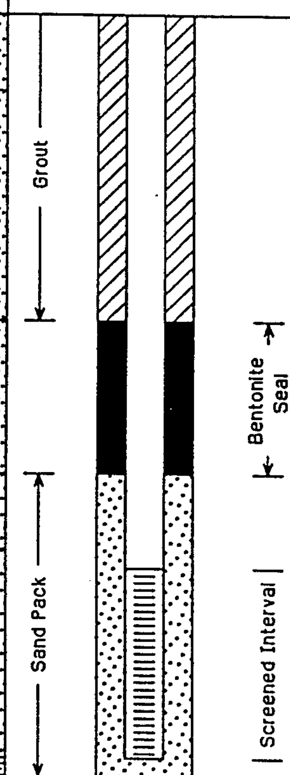
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-MWD19
Geologist/Engineer Phil Potter

Project I.D. CCAS RFI - 727576
Client 45th Space Wing
Date Installed 19-May-96

DEPTH (feet)	SAMPLE	BLOWS/6 IN	%REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE
30	X	4,4, 3,4	70	0	200	~~SAND, v. fine, little to some silt, trace~~ shell, firm, greenish gray (5GY5/1).		SP
	X	3,3, 3,3	80	0	>1000	SAND, v. fine, and silt, little clay, firm, greenish gray (5GY5/1).	SDSL	SM
35	X	5,4, 3,3	90	0	>1000	SAND, medium to fine, some silt, some clay, little shell, firm, greenish gray (5GY5/1). 2-inch CLAY layer at 35.5'.	SDCL	
	X	3,3, 2,3	80	0	>1000	SHELLS, some silt, little clay, loose, dark greenish gray (5GY4/1).	SDCR	
	X	2,2, 3,2	70	0	>1000	SAND, v. fine, little silt, and shell, little clay, loose, dark greenish gray (5GY4/1).	SDVF	SP
40	X	5,8, 3,3	90	0	520	SAND, medium to very fine, and shell, little silt, little clay, loose, dark greenish gray (5GY4/1).	SDFN	
	X	3,4, 4,7	100	0	760	SAND, medium to fine, and shell, and clay, loose to firm, dark greenish gray (5GY4/1). 1-foot clay layer at 42.5' to 43.5'.	SDFN	SM
45	X	5,5 7,8	100	0	230	SAND, fine, and shell, little silt, little clay, loose to firm, dark greenish gray (5GY4/1). 2-inch clay stringer at 45'.	SDFN	SP
	X	4,3, 3,3	100	0	230	SAND, coarse to fine, some shell, little silt, little clay, loose, dark greenish gray (5GY4/1).	SDMD	
	X	3,4, 5,7	100	10	>1000	SAND, coarse to fine, little silt, little clay, loose to firm, dark greenish gray (5GY4/1), wet.	SDMD/ CLAY	
50						CLAY, very firm, dark greenish gray (5GY4/1), moist.		CL
						Boring terminated at 50.0'.		
55						Boring terminated at 50'.		
60								
65								

GRAPHIC LOG

WELL DIAGRAM



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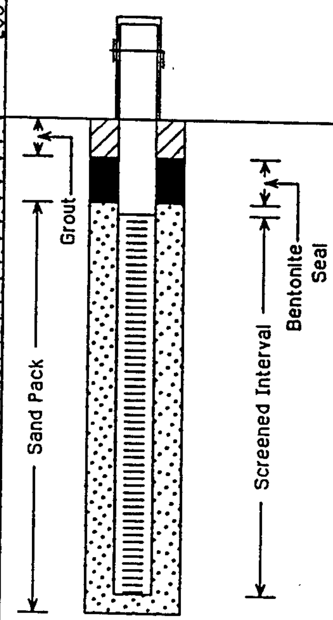
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI – 727576
Installation Cape Canaveral AS
Site Facility 1381 – Ordnance Support Facility
Boring/Well I.D. 1381-PZ01
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 04-Jun-96
Date Completed 04-Jun-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 13.0
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 04-Jun-96
Date Grouted 04-Jun-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -2.5
Screened Interval (ft) -2.5 to -12.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd – Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	0	0	Fill material with vegetative cover.		SP	
5	X	3,3, 2,3	60	0	0	SAND, medium to fine grained, trace silt, very loose, pinkish gray (7.5YR7/1), moist.	SDMD		
10	X	5,5, 6,5	60	7	0	SAND, medium to fine, and shell, very loose.	SDMD		
15						Boring terminated at 13.0 ft.			
20									
25									

WELL DIAGRAM



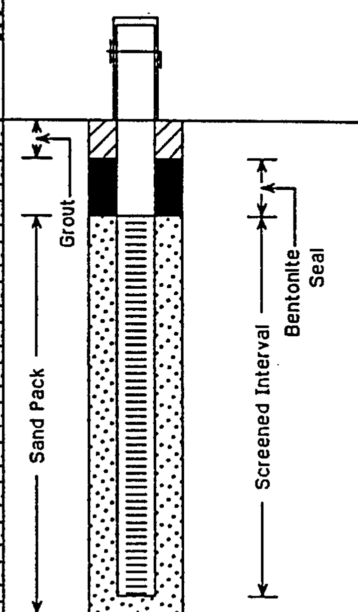
PARSONS ENGINEERING SCIENCE
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-PZ02
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 04-Jun-96
Date Completed 04-Jun-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 13.0
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 04-Jun-96
Date Grouted 04-Jun-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -2.5
Screened Interval (ft) -2.5 to -12.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd = Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	0	0	Fill material with vegetative cover.		SP	
5	X	4,4, 3,4	60	0	0	SAND, medium to fine grained, little shell, very loose, pale yellow (2.57/3), wet.	SDMD		
10	X	5,5, 4,5	70	0	0	SAND, coarse, and shell, trace silt, very loose, gray (N5/), wet.	SDCR		
15						Boring terminated at 13.0 ft.			
20									
25									

WELL DIAGRAM



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PARSONS ENGINEERING SCIENCE

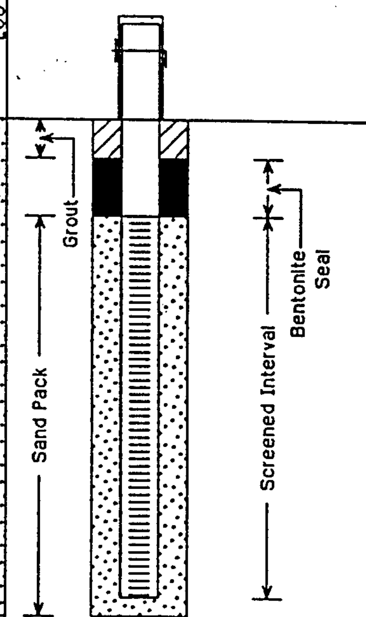
SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Project I.D. CCAS RFI - 727576
Installation Cape Canaveral AS
Site Facility 1381 - Ordnance Support Facility
Boring/Well I.D. 1381-PZ03
Geologist/Engineer Phil Potter
Drilling Method Hollow Stem Auger
Sampling Method 2 1/4" Split Spoon
Date Started 04-Jun-96
Date Completed 04-Jun-96
Driller EDS
Borehole Diameter (in) 9.00
Depth Drilled (ft) 13.0
Ground Elevation (ft)
X-Coordinate
Y-Coordinate

Client 45th Space Wing
Date Installed 04-Jun-96
Date Grouted 04-Jun-96
Casing Material 2" PVC
Screen Material 2" PVC 0.01 slot
Casing Interval (ft) +2.5 to -2.5
Screened Interval (ft) -2.5 to -12.5
Sump Installed? Yes
Pad Installed? Yes
Well Depth (ft) 13.0
Depth to Water BTOC (ft)
Date Measured
TOC Elevation (ft)
Water Level MSL (ft)

DEPTH (feet)	SAMPLE	BLOWS/6 IN	% REC.	OVA (sample) Unfltrd - Fltrd * Adjstd (ppm)	OVA (borehole) (ppm)	LITHOLOGIC DESCRIPTION	LITHCODE	ASTMCODE	GRAPHIC LOG
0		NA	NA	0	0	Fill material with vegetative cover.		SP	
5	X	NR	30	0	0	SAND, coarse to medium grained, very loose, pinkish white (7YR8/2), wet.	SDCR		
10	X	NR	60	0	0	SAND, medium to fine grained, and shell, very loose, gray (N5/), wet.	SDMD		
						Boring terminated at 13.0 ft.			
15									
20									
25									

WELL DIAGRAM



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APPENDIX B

ANALYTICAL METHODS, DATA USE, AND PACKAGING

REQUIREMENTS FOR SOIL AND GROUNDWATER SAMPLES

APPENDIX B

ANALYTICAL METHODS, DATA USE, AND PACKAGING

REQUIREMENTS FOR SOIL AND GROUNDWATER SAMPLES

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Soil/ Sediment	Total volatile and extractable hydrocarbons,	Gas chromatography (GC) method SW8015 [modified]	Handbook method; reference is the California LUFT manual	Data are used to determine the extent of soil contamination, the contaminant mass present, and the need for source removal	Each soil sampling round	Collect 100 g of soil in a glass container with Teflon-lined cap; cool to 4°C	Fixed-base
Soil/ Sediment	Aromatic and Chlorinated hydrocarbons ([BTEX, PCE, TCE, DCE, VC)	Purge and trap GC method SW8240	Handbook method modified for field extraction of soil using methanol	Data are used to determine the extent of soil contamination, the contaminant mass present, and the need for source removal	Each soil sampling round	Collect 100 g of soil in a glass container with Teflon-lined cap; cool to 4°C	Fixed-base
Soil	Total organic carbon (TOC)	SW9060 modified for soil samples	Procedure must be accurate over the range of 0.01 - 15 percent TOC	The rate of migration of petroleum contaminants in groundwater is dependent upon the amount of TOC in the aquifer matrix.	At initial sampling	Collect 100 g of soil in a glass container with Teflon-lined cap; cool to 4°C	Fixed-base
Soil	Moisture	ASTM D-2216	Handbook method	Data are used to correct soil sample analytical results for moisture content (e.g., report results on a dry weight basis)	Each soil sampling round	Use a portion of soil sample collected for another analysis	Fixed-base

APPENDIX B (continued)

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Water	Aromatic and chlorinated hydrocarbons (BTEX, trimethylbenzene isomers, PCE, TCE, DCE, VC, chloromethane, chloroform, other relevant compounds)	Methods SW8010/8020 or SW8240	Handbook methods; analysis may be extended to higher molecular weight alkylbenzenes	Method of analysis for BTEX & CAHs, which are the primary target analytes for monitoring natural attenuation; BTEX & CAH concentrations must also be measured for regulatory compliance; trimethylbenzenes are used to monitor BTEX plume dilution if degradation is primarily anaerobic. Chloromethane and chloroform are indicators of CAH contamination by aerobic pathways.	Each sampling round	Collect water samples in a 40 mL VOA vial; cool to 4°C; add hydrochloric acid to pH 2	Fixed-base
Water	Polycyclic aromatic hydrocarbons (PAHs) (optional)	GC/mass spectroscopy method SW8270; high-performance liquid chromatography method SW8310	Analysis needed only when required for regulatory compliance.	PAHs are components of fuel and are typically analyzed for regulatory compliance; data on their concentrations are not used currently in the evaluation of natural attenuation	As required by regulations	Collect 1 L of water in a glass container; cool to 4°C	Fixed-base
Water	Oxygen	Dissolved oxygen meter	Refer to method A4500 for a comparable laboratory procedure	The oxygen concentration is a data input to the Bioplume model; concentrations less than 1 mg/L generally indicate an anaerobic pathway	Each sampling round	Measure dissolved oxygen on site using a flow-through cell	Field

APPENDIX B (continued)

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Water	Nitrate	IC method E300	Method E300 is a Handbook method.	Substrate for microbial respiration if oxygen is depleted.	Each sampling round	Collect up to 40 mL of water in a glass or plastic container; add H_2SO_4 to pH 2, cool to 4°C	Fixed-base
Water	Iron (II) (Fe^{+2})	Colorimetric Hach Method # 8146	Filter if turbid.	May indicate an anaerobic degradation process due to depletion of oxygen, and nitrate.	Each sampling round	Collect 100 mL of water in a glass container	Field
Water	Sulfate (SO_4^{-2})	IC method E300	Method E300 is a Handbook method, if this method is used for sulfate analysis, do not use the field method.	Substrate for anaerobic microbial respiration	Each sampling round	Collect up to 40 mL of water in a glass or plastic container; cool to 4°C	Fixed-base
Water	Sulfate (SO_4^{-2})	Hach method # 8051	Colorimetric, if this method is used for sulfate analysis, do not use the fixed-base laboratory method.	Same as above	Each sampling round	Collect up to 40 mL of water in a glass or plastic container; cool to 4°C	Field
Water	Methane, ethane, and ethene	Kampbell *et al.*, 1989 or SW3810 Modified	Method published by researchers at the US Environmental Protection Agency.	The presence of CH_4 suggests BTEX or other carbon degradation via methanogenesis. Ethane and ethene data are used where chlorinated solvents are suspected of undergoing anaerobic biological transformation	Each sampling round	Collect water samples in 50 mL glass serum bottles with butyl gray/Teflon-lined caps, add H_2SO_4 to pH 2, cool to 4°C	Fixed-base

APPENDIX B (continued)

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Water	Carbon dioxide	Hach test kit model CA-23; Chemetrics Method R-1910	Titrimetric; alternate method	The presence of free CO_2 dissolved in groundwater is unlikely because of the carbonate buffering system of water, but if detected, the CO_2 concentrations should be compared with background levels to determine if they are elevated; elevated concentrations of CO_2 could indicate biodegradation of dissolved contaminants.	Each sampling round	Collect 100 mL of water in a glass container	Field
Water	Alkalinity	Hach Alkalinity test kit model AL AP MG-L	Phenolphthalein method	General water quality parameter used (1) as a marker to verify that all site samples are obtained from the same groundwater system and (2) to measure the buffering capacity of groundwater	Each sampling round	Collect 100 mL of water in glass container	Field
Water	Oxidation-reduction potential (ORP)	A2580B	Measurements made with electrodes; results are displayed on a meter; protect samples from exposure to oxygen Report results against a silver/silver chloride reference electrode	The ORP of groundwater influences and is influenced by the nature of the biologically mediated degradation of contaminants; the ORP of groundwater may range from more than 800 mV to less than −400 mV	Each sampling round	Collect 100–250 mL of water in a glass container, filling container from bottom; analyze immediately	Field

APPENDIX B (continued)

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
Water	pH	Field probe with direct reading meter.	Field	Aerobic and anaerobic processes are pH-sensitive.	Each sampling round	Collect 100–250 mL of water in a glass or plastic container; analyze immediately	Field
Water	Temperature	Field probe with direct reading meter.	Field only	Well development.	Each sampling round	Not Applicable	Field
Water	Conductivity	E120.1/SW9050, direct reading meter	Protocols/Handbook methods	General water quality parameter used as a marker to verify that site samples are obtained from the same groundwater system.	Each sampling round	Collect 100–250 mL of water in a glass or plastic container	Field
Water	Chloride	Mercuric nitrate titration A4500-Cl^- C	Ion chromatography (IC) method E300 or method SW9050 may also be used	General water quality parameter used as a marker to verify that site samples are obtained from the same groundwater system; elevated concentrations may also indicate biodegradation of CAHs.	Each sampling round	Collect 250 mL of water in a glass container	Fixed-base
Water	Chloride (optional, see data use)	Hach Chloride test kit model 8-P	Silver nitrate titration	As above, and to guide selection of additional data points in real time while in the field	Each sampling round	Collect 100mL of water in a glass container	Field
Water	Total Organic Carbon		Laboratory	Used to classify plume and to determine if CAH biodegradation is possible in the absence of anthropogenic carbon.	Each sampling round	Collect 100 mL of water in a glass container, cool	Laboratory

APPENDIX B (concluded)

Matrix	Analysis	Method/Reference	Comments	Data Use	Recommended Frequency of Analysis	Sample Volume, Sample Container, Sample Preservation	Field or Fixed-Base Laboratory
ADDITIONAL (OPTIONAL) ANALYSES							
Water	Biochemical Oxygen Demand	EPA Method 405.1			Each sampling round	Collect 2 L of water in a glass container, cool	Laboratory
Water	Hydrogen (H_2)		Relatively new analysis; data useful for evaluating biodegradation processes operating at a given time	Indicator of terminal electron-accepting processes operating at a site.	Each sampling round	to be determined	
Water	Oxygenates (including methanol and acetone)	Optional: SW 8015 Modified			Each sampling round	Collect water samples in a 40 mL VOA vial; cool to 4°C; add hydrochloric acid to pH 2	Laboratory
Water	Alcohols, ethers, and acetic acids	Optional. SW 8015 Modified		Optional carbon sources for biodegradation.	Each sampling round	Collect water samples in a 40 mL VOA vial; cool to 4°C; add hydrochloric acid to pH 2	Laboratory
Water	Acetaldehydes	Optional. GC/MS method to be determined			Each sampling round	to be determined	Laboratory
Water	Aliphatic Fatty Acids	Optional. GC/MS method to be determined		Byproducts of biodegradation processes, indicators of biodegradation and cometabolism.	Each sampling round	to be determined	Laboratory
Water	Organic Acids	Optional. GC/MS method to be determined		Optional carbon sources and byproducts of biodegradation processes	Each sampling round	to be determined	Laboratory

NOTES:

* Analyses other than those listed in this table may be required for regulatory compliance.

1. "Hach" refers to the Hach Company catalog, 1990.
2. "A" refers to *Standard Methods for the Examination of Water and Wastewater*, 18th edition, 1992.
3. "E" refers to *Methods for Chemical Analysis of Water and Wastes*, USEPA, 1983.
4. "Protocols" refers to the AFCEE *Environmental Chemistry Function Installation Restoration Program Analytical Protocols*, 11 June 1992.
5. "Handbook" refers to the AFCEE *Handbook to Support the Installation Restoration Program (IRP) Remedial Investigations and Feasibility Studies (RI/FS)*, September 1993.
6. "SW" refers to the *Test Methods for Evaluating Solid Waste, Physical, and Chemical Methods*, SW-846, USEPA, 3rd edition, 1986.
7. "ASTM" refers to the *American Society for Testing and Materials*.
8. "LUFT" refers to the State of California *Leaking Underground Fuel Tank Field Manual*, 1988 edition.

APPENDIX C

INSTALLATION DIAGRAMS OF PILOT AIR SPARGING SYSTEM

CCAS FAC 1381
AIR SPARGING PILOT TEST LOCATION

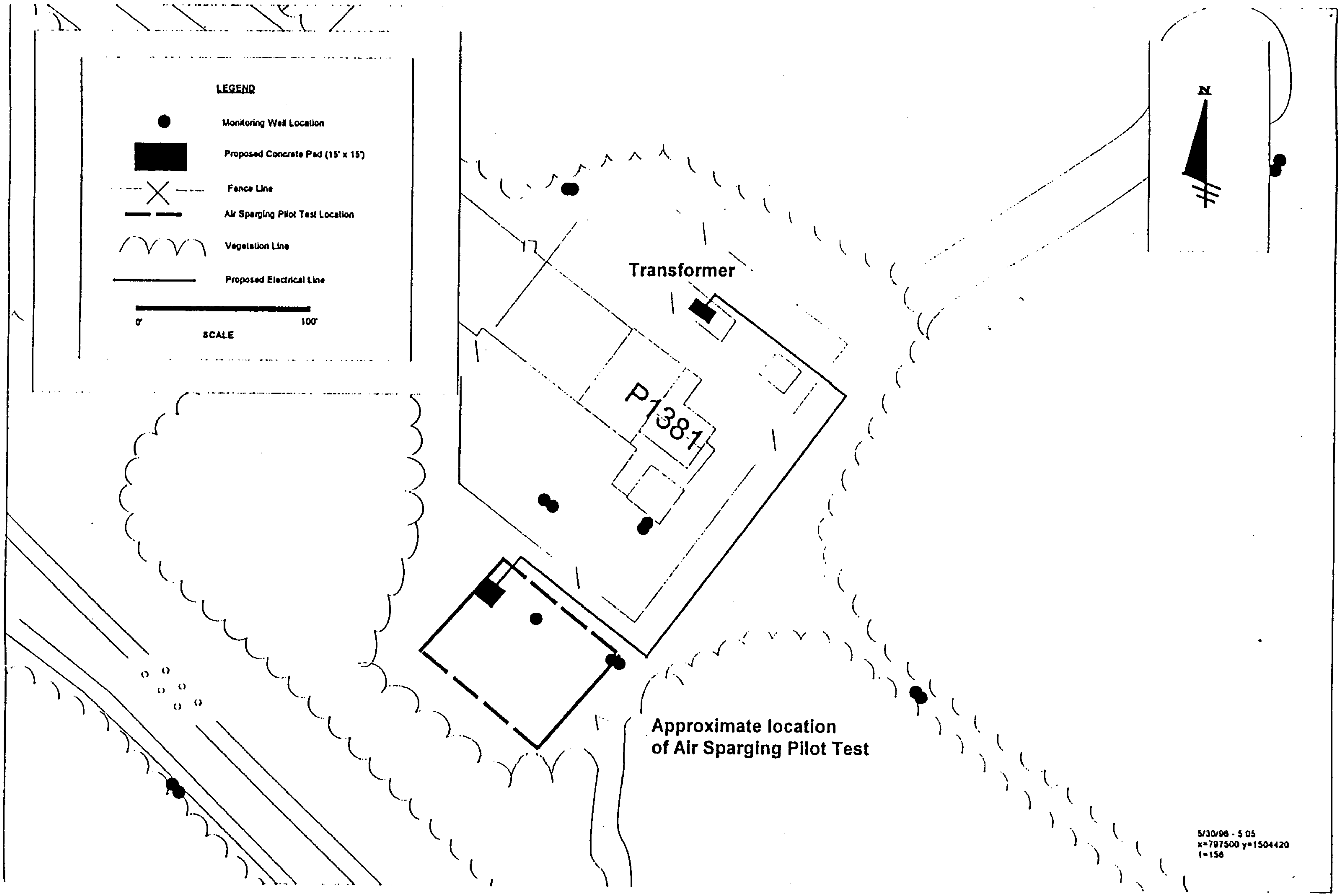
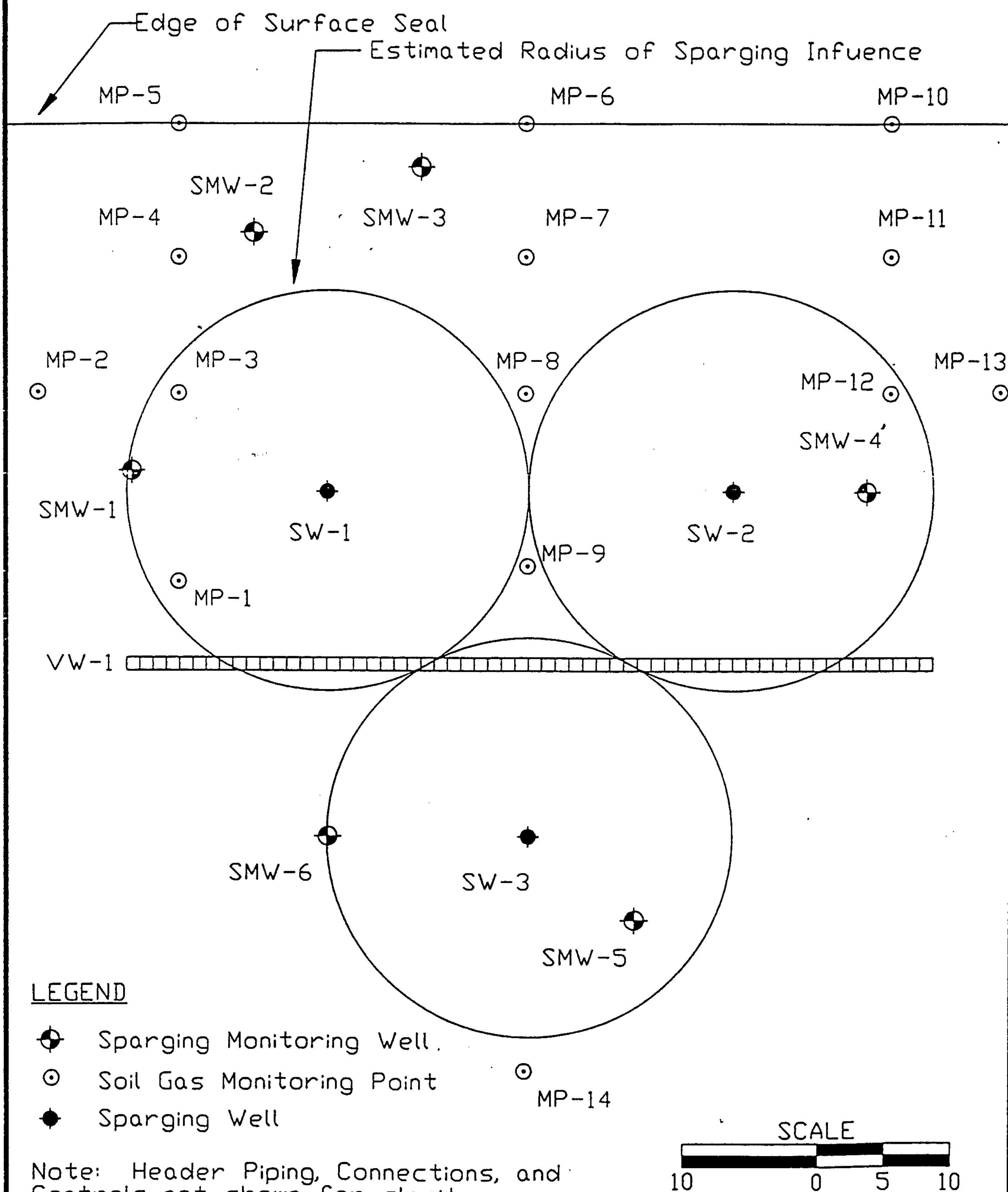


FIGURE 4-1

PILOT TEST LAYOUT

CCAS FACILITY 1381

Air Sparging Work Plan
Section 4
Revision: 0
Date: March 4, 1996
Page 8



Note: Header Piping, Connections, and Controls not shown for clarity.

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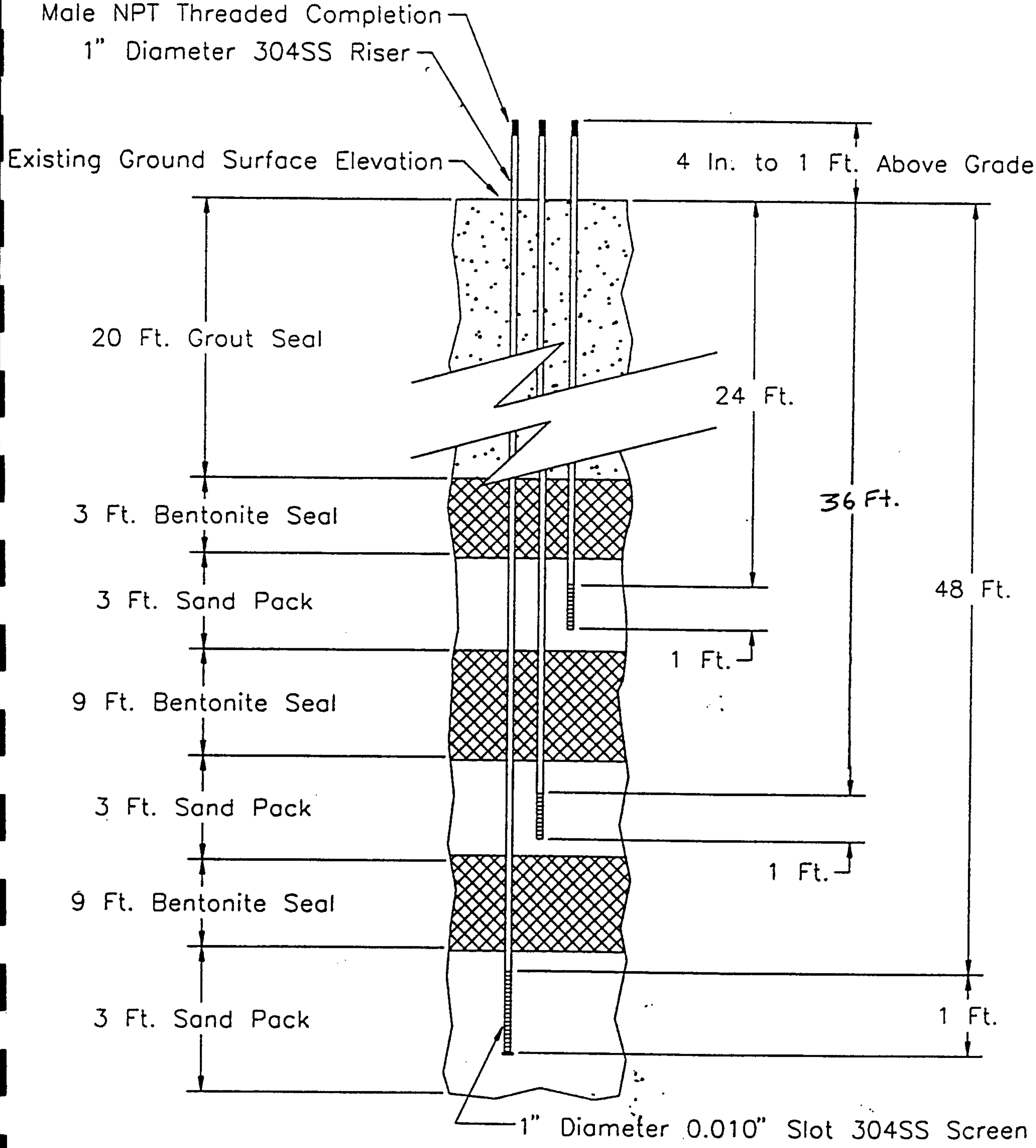
PARSONS ENGINEERING SCIENCE, INC.

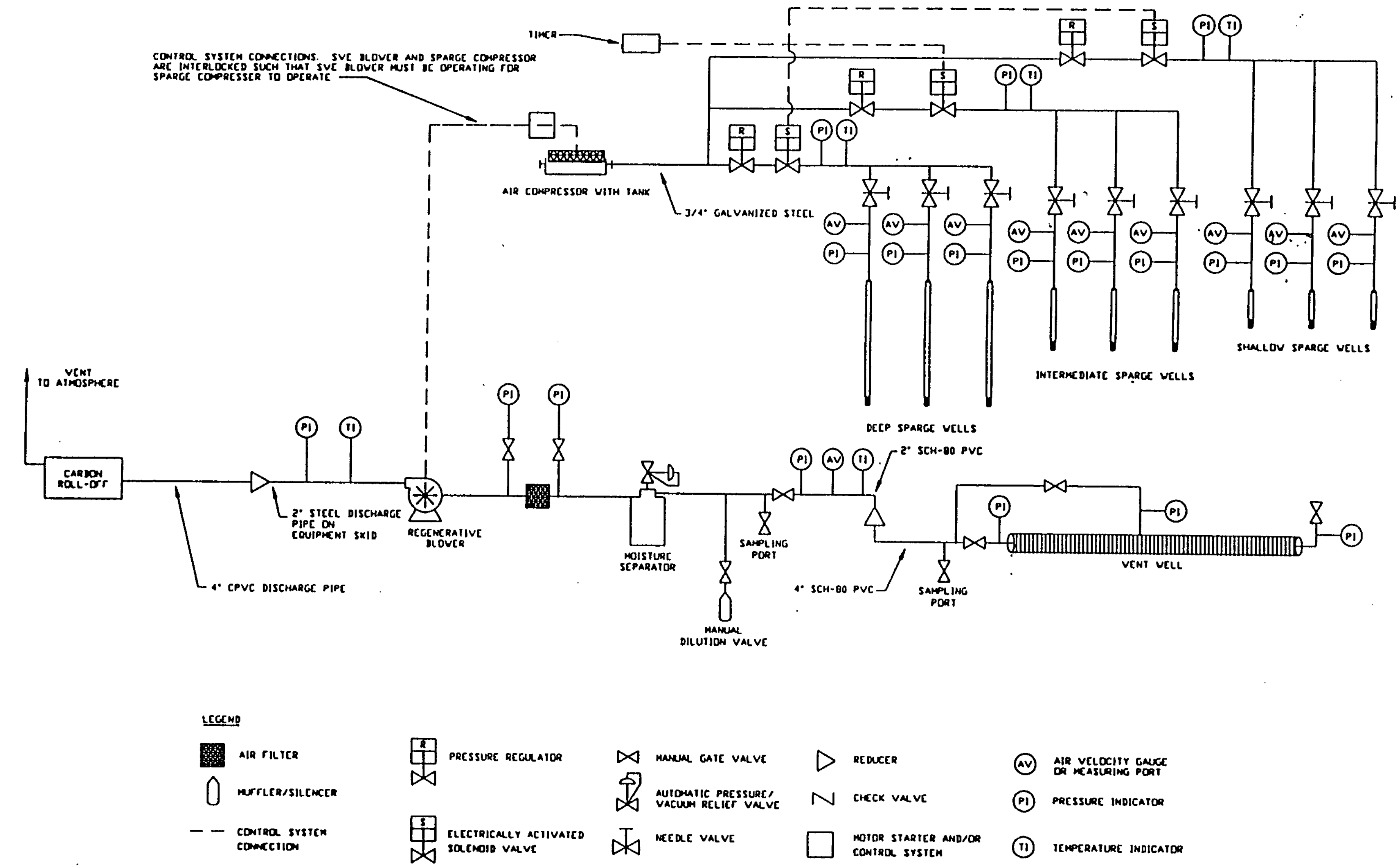
AIR SPARGING WELL CONSTRUCTION DETAILS

CCAS FACILITY 1381



PROCESS FLOW DIAGRAM

CCAS FACILITY 1381



PARSONS ENGINEERING SCIENCE, INC.

CCAS FAC 1381
AIR SPARGING PILOT TEST LOCATION
SHALLOW GROUNDWATER RESULTS

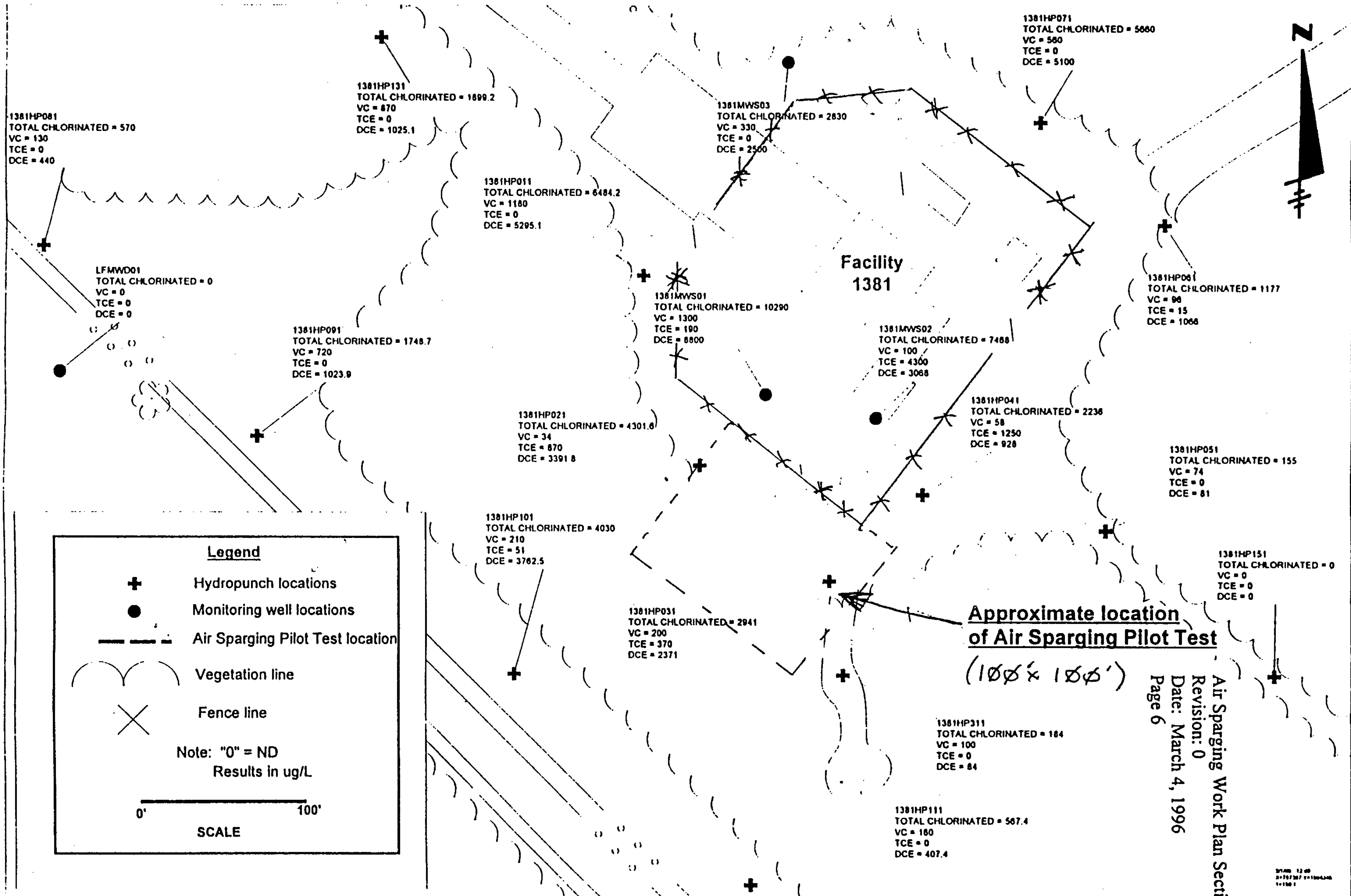
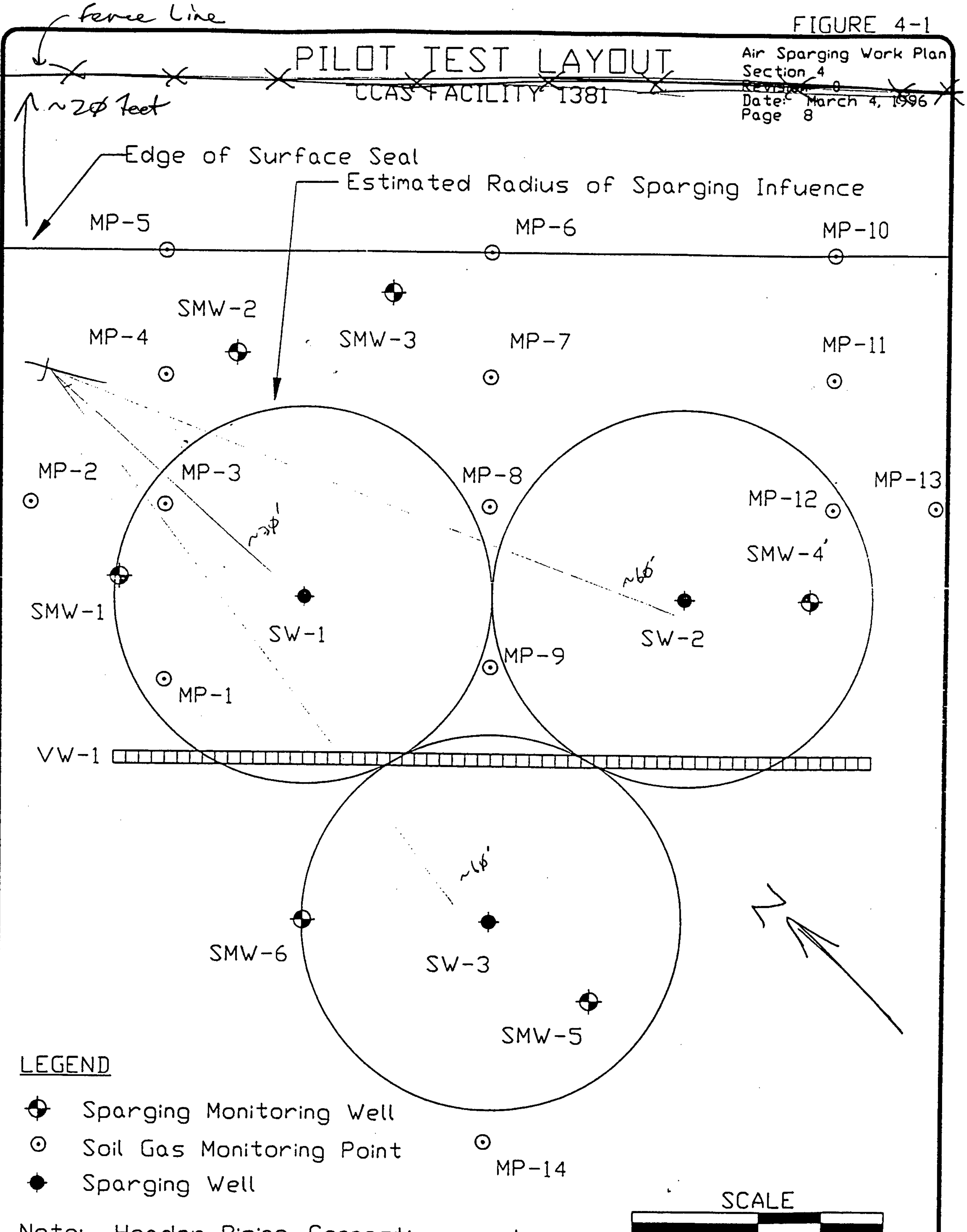


FIGURE 4-1

Air Sparging Work Plan
Section 4
Revision 0
Date: March 4, 1996
Page 8

PILOT TEST LAYOUT
CCAS FACILITY 1381



LEGEND

- Sparging Monitoring Well
- Soil Gas Monitoring Point
- Sparging Well

Note: Header Piping, Connections, and Controls not shown for clarity.

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